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ABSTRACT

Two booklets comprise the grades 10-12 component of a series of guides for incorporating environmental education into the existing curriculum. The guide and handbook emphasize a multidisciplinary approach, use the concept of interdependence as an organizing theme, and offer suggestions for using the local community as a resource. The guide outlines nine objectives, including awareness of relationships between seemingly local concerns and global networks, knowing that quality of life of individuals and communities is directly influenced by increasing worldwide interdependence, and recognizing that population and other environmental issues involve deep conflicts of interest. Multidisciplinary approaches for reaching these goals involve students in analyzing effects of the 1972-75 grain shortage in the USSR on U.S. food prices, labor unions and dock workers, and inflation in Japan and England. In another approach, students develop a television documentary perspective of rich and poor persons on environmental concerns. The handbook contains teaching strategies and student materials for nine lessons. These include studying population growth in countries with varied resources and examining oceans in terms of overfishing, pollution, and control questions. A concluding essay summarizes concerns of natural resources, human needs, and quality of life. (AV)

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Part D
10-12 Guide

U.S. DEPARTMENT OF HEALTH,
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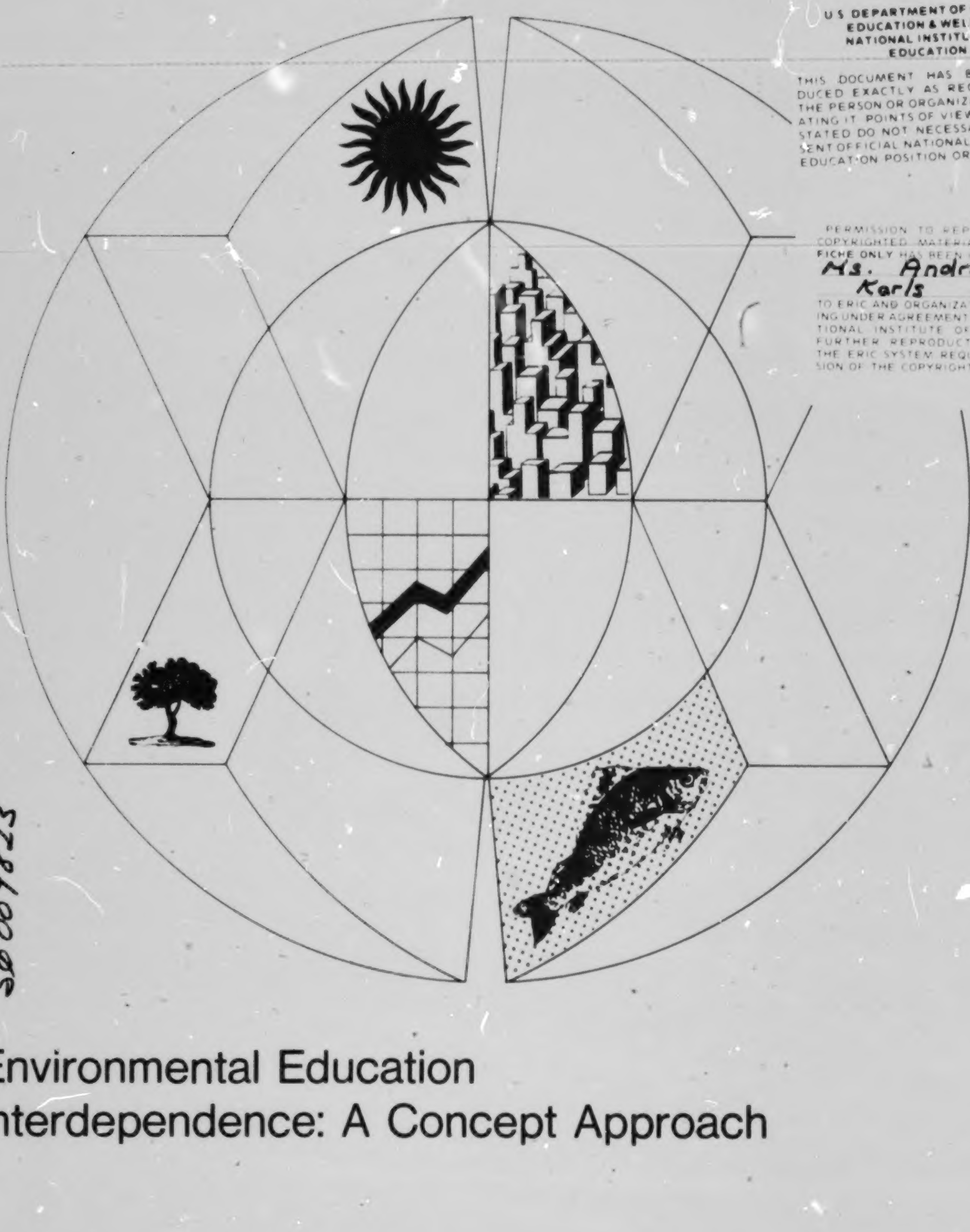

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Environmental Education
Interdependence: A Concept Approach

CENTER FOR GLOBAL PERSPECTIVES

DAVID C. KING

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ENVIRONMENTAL EDUCATION

INTERDEPENDENCE: A CONCEPT APPROACH

SUGGESTIONS FOR CURRICULUM DEVELOPMENT

PART D, 10-12

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ENVIRONMENTAL EDUCATION

INTERDEPENDENCE: A CONCEPT APPROACH

INTRODUCTION TO THE SERIES

PURPOSE

The purpose of this series of guides is to provide:

- strategies for incorporating environmental education into the existing curriculum (it is not a blueprint for a new course);
- a variety of ideas, questions to explore, and suggestions for lessons and activities which will allow teachers and curriculum developers to select those portions which best meet their particular needs;
- exemplary lessons -- which should prove useful in themselves and also offer ideas for your own curriculum development;
- an emphasis on multi-disciplinary approaches, since study of the environment is not limited to any single discipline or subject area;
- suggestions for using the local community as a resource for learning about population and other environmental concerns;
- an organizing theme around the concept of interdependence -- a conceptual lens which will provide students with a new way of organizing information and of looking at the world around them.

EDUCATION FOR ENVIRONMENTAL HEALTH

> Environmental education is not a new class to teach. Rather it is a fresh way to approach, consider and apply what you are already teaching ~~in the~~ classroom.[1]

> When we move into the areas of the social sciences, arts, and humanities, which once were considered unrelated, the outlines of a curriculum begin to emerge that not only will help children understand their interdependence with the natural world, but will help them develop the skills, attitudes, and knowledge necessary to understand and solve environmental problems.[2]

These two quotations stress the same point: environmental education is an integral part of the existing curriculum rather than a separate area of study. Perhaps that needs to be explained a little more fully.

Environmental education involves more than concern for the protection of wildlife or awareness that humans are poisoning the environment. Conservation and awareness are important, but they are only parts of a larger whole. In its fullest sense, environmental education involves *the individual's relationship to his or her total environment* -- and that includes the built environment as well as the natural. Every course we teach has something to do with how people relate to each other and to their world.

From every corner of the curriculum, then, there can emerge the skills, attitudes and information young people need for a creative approach to their environment. The major goal of environmental education is not to persuade students to launch or participate in anti-pollution campaigns. Much more basic is the objective of helping them learn to use all their senses to "reconnect" them with their natural and human-made surroundings. Each of us shapes and is shaped by the environment. The challenge to educators is to provide an education that will enable people to recognize areas of individual and group responsibility for their surroundings. They can then work intelligently toward structuring a healthy environment, instead of passively accepting whatever they find around them. Such a goal becomes increasingly vital as our world becomes more crowded and more urbanized.

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[1] The American Institute of Architects, *Built Environment; a Teacher Introduction to Environmental Education*, 1975, p. 7.

[2] *Ekistics*, A Guide for the Development of an Interdisciplinary Environmental Education Curriculum, California State Department of Education, Sacramento, 1973, p. v.

INTERDEPENDENCE: THE ORGANIZING THEME

The idea of *interdependence* is deceptively simple. It means *mutual dependence* -- parts of the whole depending on each other. The term has become popular in the past few years as a key means of describing the nature of life on our planet. Such terms as Spaceship Earth or Global Village are more dramatic ways of stating the fact that we live in an increasingly interdependent world where the parts of the whole depend more and more on each other.

We constantly encounter interdependence in our daily lives and in the subjects we teach. When children learn about families or communities, they are learning about interdependent relationships. Similarly, the study of life in the ecosystem of a pond is a study of systems -- or interdependence -- as is the study or analysis of the functions of different aspects of government, the workings of an economy, or the interaction of characters in a play.

Although much of what we teach deals with interdependence, we have not really tried to help students understand the concept itself. Events are too often treated as isolated phenomena. Children are not trained to see a similarity between, say, what's involved in a unit on buying and selling and what happens in the microscopic life of a pond. One similarity is that both involve systems (interdependence).

This set of guides uses examples of systemness or interdependence to help students understand the concept. There is an underlying assumption: as young people become more familiar with the concept, they become better equipped to understand and cope with interdependence -- whether it involves their relations with others, with their environment, or with a subject being studied in school. Here is a simple example:

Without any major changes in curriculum, the child begins to see his or her world as being made up of an endless series of systems and subsystems. A tree is a system; so is the human body. A road map describes a road system; an equation describes a numbers system. A house is a system, so is the neighborhood, and the community is an even larger system composed of hundreds of subsystems. Through experience, the child becomes able to see the world through a systems lens; where appropriate, he or she puts on the systems spectacles and can then see how parts of a whole relate to each other, how the system functions, what variables might interfere with its smooth operation, how it is similar to and different from other systems.

The concept thus becomes a tool to use for organizing information. With increased experience it can be applied to ever-more complex and sophisticated subject matter. An increase in population can be analyzed in terms of the many systems and subsystems involved. The student automatically knows what questions to ask about the consequences of this population change on space, food, light, other species, and so on. Students will develop the skills needed to minimize the negative results of systems change on their own lives. Finally, understanding of the concept enables the person to recognize the interactions between self and immediate surroundings and between immediate surroundings and the total environment of the planet itself.

This conceptual lens is not magic, nor does it provide everything people need to know to understand their relationship to their environment. But it does provide part of the equipment people need to attain that understanding and to respond to it in creative ways.

We said earlier that the idea of interdependence is deceptively simple. Obviously younger children will deal with it on less complicated levels, applying it to their familiar surroundings. However, when high school students explore the intricacies of global interdependence, they will be aware of the complexities, pressures, and tensions involved.

Robert G. Hanvey describes the complex nature of the subject:

> How does the world work? As a system. What does that mean? It means put aside simple notions of cause and effect. Things interact, in complex and surprising ways. "Effects" loop back and become "causes" which have "effects" which loop back...It means simply that events ramify -- unbelievably.[3]

Consider an example: The Organization of Petroleum Exporting Countries (OPEC) quadrupled the price of oil. This caused an increase in the price of petroleum-based fertilizers (effect), which in turn made it difficult (cause) for a farmer in India to produce a good crop yield (effect) since the new strains of grain developed by the Green Revolution, created (cause) to increase world food supply (effect).

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[3] Robert G. Hanvey, *An Attainable Global Perspective*, Center for War/Peace Studies, 1975.

rely heavily on those fertilizers. At the same time the oil price increase set off other chains -- increased inflation, the decision to build the Alaska Pipeline, lessening of aid to poor countries, and so on. A student with a solid background knowledge of interdependence has the tools to analyze and understand such a maze of interrelated events.

USING THE GUIDES

The curriculum guides are divided into grade clusters (K-3, 4-6, 7-9, 10-12). In each, we have presented a framework or outline describing ideas, suggestions, and activities for topics normally taught at these grade levels. The suggestions listed under each topic will indicate ways you can use your existing course work to develop better understandings of population and other environmental concerns through the concept of interdependence.

When you are planning a unit of study, refer to the relevant portions of the guide. Incorporate some of the activities or exploratory questions into your lesson plans. The guide, then, becomes something like a transparency that you place over your unit plans in order to see where you can add important elements of environmental education. You will also find that the sample lessons can be used for certain key topics, and as models for developing your own lessons.

While many of the topics listed in the guide emerge from social studies, we will frequently be crossing over into art, literature, science, and mathematics. This interdisciplinary approach will probably be easy for elementary-grade teachers to handle. In middle and upper grades, combining courses is more difficult, since there is often little coordination among teachers of different subject areas. We strongly urge team-teaching wherever possible, or at least a close working relationship among teachers. The students will gain tremendous benefits if there is a meshing of subject areas in dealing with environmental education. Faculty or inter-departmental meetings can be used to work out broad areas of coordination among the various subjects.

RESOURCES AND BIBLIOGRAPHIES

Even though most teachers are familiar with the basics of curriculum planning and development, they may find it desirable to review some of the current literature. Two extremely helpful reference books are *Education Index and Books in Print.* Look under subject areas such as "curriculum," "environmental education," or "conservation education." In addition, Educational Resources Information Center (ERIC) publishes a monthly index, *Research in Education* (RIE) which has an excellent collection of environmental education documents, including many produced by some interesting programs supported by HEW under Title III and the Environmental Education

Act of 1970. All three publications are found in most major libraries.

If you wish to develop materials especially for your local needs and resources, you should get in touch with the directors of model programs throughout the country. Their names, addresses, and telephone numbers are listed in *A Directory of Projects and Programs in Environmental Education for Secondary Schools* by John F. Desinger and Beverly Lee (ERIC, The Ohio State University Press, 400 Lincoln Tower, Columbus, Ohio 43210). Also see *Environment U.S.A.: A Guide to Agencies, People and Resources* (R.R. Bowker, P.O. Box 1807, Ann Arbor, Michigan 48106. 1974)

At the end of each unit in this Guide, you will find additional resources. They are by no means complete or comprehensive, but are intended to serve as general and supplemental readings. You may also discover that readings listed in one unit will be helpful in expanding material found in another unit of the Guide. We hope that the Guide, and the references, will provide you and your students with additional ideas for developing the curricula.

SUGGESTIONS FOR CURRICULUM DEVELOPMENT

ENVIRONMENTAL EDUCATION

GRADES 10 - 12

INTRODUCTION

The ideas and activities outlined here are suggestions only, and some will fit your teaching needs better than others. Also, you will undoubtedly find additional places in the curriculum where class work can help develop objectives leading to one of the basic understandings. Use these as you can, and please let us know about them. We are very anxious to know about the different ways teachers, students, curriculum specialists, and administrators have found to achieve concept learning.

Remember, too, that repetition of the word *interdependence* can be tedious for the students, and that you can approach any of these activities through content rather than the concept. Perhaps the best rule of thumb is to use the terminology when you feel it necessary to help the class make that transfer to filing information or experience according to their mental image of interdependence. Or, when some important modification of their construct has been encountered. Even then, you can often achieve this by simply asking "how is this case similar to the one we encountered in ________?"

The suggestions are in the form of outlines of units. These can best be developed by combining activities in a number of course areas. This requires a lot of work and planning throughout each unit. If you have the time to do this, the rewards for you and the students will be well worth the effort. If such coordination is not possible, you can still make use of the activities in whichever course you teach. Use the column in the left-hand margin to locate the areas of study you will be dealing with and select from that section learning activities which best apply to your course materials.

OBJECTIVES

(Listed below are some broad objectives, at least one of which should be the target of every lesson developed from the guide. The specific knowledge, skills, and attitude objectives can best be developed by you, the teachers, as you prepare individual units and lessons.)

1. To use a wide variety of activities to explore the natural and human-made (built) environment.

   Example: Students will view human-environment interactions in other cultures through art, literature, text materials and writing.

2. To recognize the complex operations of interdependent relationships both in their immediate surroundings and in the larger global setting.

   Example: Given an event in one region of the planet, students will evaluate how it will affect other regions, including their own community.

3. To develop those skills in which individual students are interested, in order to express their feelings about human-environment concerns.

   Example: Assignments which allow students to use art, poetry, prose writing, etc. to describe their thoughts and reactions.

4. To recognize that a healthier environment depends on people selecting among difficult choices and carefully measuring the consequences of those selections.

   Example: Students will role-play a local environmental controversy to learn more about conflicting interests and viewpoints.

5. To understand that cultural differences determine the variations in ways humans adapt to and alter their surroundings.

   Example: Students will compare ways in which different cultures adapt to and change the same or similar environments.

6. To develop increased awareness of the relationship between seemingly local concerns and global networks.

   Example: Students will measure the widespread ramifications of a local change in the natural environment.

7. To recognize that population changes influence all other environmental issues.

   Example: Students will hypothesize about ways in which changes in population (distribution or numbers) will alter demands on natural systems.

8. To know that the quality of life of individuals and communities is directly influenced by increasing world-wide interdependence.

   Example: Students will evaluate ways in which world-wide urbanization influences life in their own community.

9. To recognize that population and other environmental issues involve deep conflicts of interest and viewpoint.

   Example: Students will develop a television documentary of rich/poor perspectives on environmental concerns.

TOPIC AND IDEA OUTLINE

I. SYSTEMS: BEGINNING TO UNDERSTAND INTERDEPENDENCE

Note: We recommend using some of the definitional activities described in this section, before proceeding with other sections of the guide. However, if students have had previous work with the idea of systems and interdependence, you can go right to one of the later sections.

A. Introducing the Idea of Systems

GOALS

- To understand the basic meaning of systems.
- To realize that parts of a system interact.
- To identify increasingly complex systems.

1. Ask, in class, for ideas about what the word *system* means. What are some examples of systems?
2. Ask a volunteer to look up the word in a dictionary. Write the basic definition on the board; compare this with the initial ideas.
3. Provide a series of pictures or slides (about a dozen) that will challenge the class to identify increasingly complex systems and how their parts interact. Some samples:
   a. A bicycle. Ask: What are the parts of the system? What if one part doesn't work? (The whole system will malfunction or fail.)
   b. A tree. How does each part function to keep the plant alive?
   c. An automobile. You can introduce the idea of a variety of subsystems (electrical, fuel, transmission, etc.) making up a total system. Notice, too, a vehicle depends on other outside systems - fuel, highway, traffic laws, etc.
   d. A person working with hand tools to make an object. Here there is an interaction among systems (human and tools) to create a new system.
   e. A small group - like a meeting, a picnic, a sport. Ask the class how some human groups can be considered systems. (The parts must work together.) What can go wrong with a human system? (Someone fails to perform; difficulties over ideas, personalities, etc.)

B. Systems and Interdependence

GOALS

- To identify interdependence as a function of systems.
- To realize that world events can be explained in terms of systems and interdependence.

1. Introduce the word *interdependence* (or *mutual dependence*) as a term that describes how systems function.
2. Ask volunteers how parts of systems they've encountered are *interdependent.* (The parts depend on each other.)
3. Explain that systems and interdependence are important ways of understanding complex events in the world around us - that some of their work in the next few weeks will involve analyzing a wide variety of systems and how their lives are influenced by them.

   Begin immediately with lessons that will give students experience with these concepts as suggested in the rest of this outline.

RESOURCES

Further expansion of ideas on interdependence can be found in materials developed by the Center for Global Perspectives for the project, Global Perspectives: A Humanistic Influence on the Curriculum. See *Interdependence* 10-12 (guide) and *Patterns for Teaching Interdependence* 10-12 (sample lessons). 1975.

II. EXPLORING THE ENVIRONMENT

A. The Natural Environment and Human Needs

GOAL

- To identify and describe the interactions between humans and the environment (human/environmental), using several different disciplines.

Many people simply don't notice the vital and constant interactions between humans and environment. A major goal of environmental education is to bring students into touch with their surroundings by probing some of the endless connections between ourselves and environmental systems.

MULTI-DISCIPLINARY

1. Explore how we rely on the natural environment to meet basic human needs.

   a. *Biology* or *Earth Science* classes can prepare a review or survey -- perhaps, in display form -- of how our needs depend on certain elements of the natural environment.

   b. *Economics* (or any *social studies* class) can prepare similar displays on the natural resources we rely on for creating built environment (buildings, clothing, automobiles, etc.).

      This might include displays in the form of clocks showing the rate at which we are using up non-renewable resources.

   c. *Chemistry* - Have volunteers prepare reports for non-chemistry students on what is involved in certain key industries -- plastics, or the entire petrochemical industry.

   d. *History* - The colonists were confronted with a new and strange environment. Have your students develop strategies for surviving in unfamiliar surroundings. Discuss the most efficient ways to live within the balance of nature. (For additional ideas, see David C. King and Cathryn J. Long. *Shaping the Environment.* Intercom #73, Center for Global Perspectives, September 1976.)

2. In *Language Arts* and *art* classes, consider the extent to which we *need* wilderness areas, wildlife refuges, parks, etc.

   This is sometimes hard to put into words; many students may not now feel this imperative.

   a. Poetry, essays, novels can be studied from the perspective of how others express this need. (Sierra Club books, like Robinson Jeffers' *Not Man Apart* would be useful.)

   b. Volunteers could write poems or essays on this theme:

      > "Quiet, privacy, independence, initiative, and open space are real biological necessities, not frills or luxuries."
      >
      > (René Dubos)

3. Another approach to appreciating the importance of natural environment is to have students write or report on things we can learn from studying nature. These assignments should be voluntary and related to the student's personal interests.

   a. Reports or essays can be based on work in science, reading, or from films.

b. The ecology of birds, whales, ants, etc. can be used to get at what's behind the obvious.

  - What does the trained eye (or ear) sense that most of us miss?

  - How can detailed observation of a life form teach us more about life--or come to appreciate it more?

c. Some students may want to approach this activity from the perspective of the need to protect an endangered species. By marshaling their arguments they will be explaining why this particular species is valuable to humans--and other life.

B. The Built Environment and Human Needs

GOALS

- To identify the functions of the built environment.

- To describe the relationship between the built environment and the natural environment.

MULTI-DISCIPLINARY

1. Use a field trip to study particular buildings in the community or neighborhood.

   a. When were the structures built? For what purpose? Do they still fill that purpose, or another?

   b. Students can work in pairs on particular structures.

   c. Even a shopping plaza can be analyzed in terms of form and function. Consider especially what the students would do to make this portion of their built surroundings more pleasant--or more functional.

2. Have the students report on the relationship between a structure and others, and to natural environment.

   a. For example: Are there elements of natural environment in the vicinity--trees, grass, streams, etc.? Challenge students to redesign the setting to make a better combination of built and natural.

   b. Invite architects to talk to the class about the structures studied, and others. This can also lead into a discussion of how people can plan a more liveable community.

3. A variation in the above:

> "High school students looked up local projects built under WPA, HUD and Model Cities as part of various units in recent American history. They assessed the purpose of the buildings, parks or bridges and designed a works program of their own based on their analysis of the community's present needs."
>
> (American Institute of Architects, *Built Environment,* 1975)

4. Some students might want to find out about futuristic designs and prepare models or photographic displays of the works of Soleri and others.

   Talk about how such structures would fit into your community.

C. The Community as a Learning Lab

GOALS

- To explore environmental concerns in the local community.
- To propose possible solutions to local environmental problems.

Your community or city can be considered a microcosm of practically every environmental problem facing the human family. Two points should be kept in mind in studying the community as your environment.

First, what the community is--or is going to be--at least partially depends on the decisions the inhabitants make. That includes your students. Ignoring the unpleasant aspects is, in effect, a decision about the shape of your surroundings.

Second, the local, regional, and global series of environmental crises stem from the collectivity of the decisions made by individual communities. You might introduce your students to the term *paradox of the aggregate*--what an individual or group does has little impact, except when those actions are put together with everyone else's. Driving a car adds little to air pollution; Americans driving 100,000,000 cars makes a great deal of difference.

Some ideas on using your surroundings as a learning lab:

MULTI-DISCIPLINARY

1. Make a survey of the community, noting what the class finds useful, pleasant, unpleasant, in need of correction, and so on.

   This can be done through field trips, photographic trips, making use of aerial photographs, etc. A high school in England adds a special touch by arranging airplane tours of the region.

GOVERNMENT 2. Once you have made an informal inventory of the community, from eyesores to attractions, have the class look into what is being done to make it a better place to live. This will involve the practical side of *political science.*

a. If there is a Master Plan, get hold of a copy and find out how the students feel about it.

b. Choose two or three current or recent issues that involved change in the community--the closing of a factory, the building of a new one, a new housing development, etc.

(1) Find out what political forces or institutions were involved--interest groups, government agencies, voters, the courts, etc.

(2) Examine what happened--or is happening--to each issue. Has the will of the majority been carried out or has some group or agency exercised control? Has the general public been involved or is there disinterest and apathy?

(3) If interest groups were involved, how were they formed, how did they operate, what influence have they had?

(4) Does the class spot weaknesses that should be corrected--such as public disinterest; a federal decision that doesn't reflect local concerns; a court decision that could have been appealed?

(5) If an issue is still current, should the class become involved? If so, how?

(Students may feel that their status as students renders their action ineffective. Hundreds of students have proved this isn't the case. For a discussion of how one school participated in the political process because of an environmental issue, see David C. King and Cathryn J. Long, *Environmental Issues and the Quality of Life,* Intercom #82, Center for Global Perspectives, July, 1976.)

(6) If the issue has been decided, is the resolution desirable? If not, what changes would help make better decisions in the future? (e.g., Would a different approach by newspapers be helpful?)

MULTIDISCIPLINARY 3. Create your own Master Plan for the community.

Use maps, scale models, field trips, experts in various fields, and other aids to create a plan the class thinks would be workable and would make this a better and healthier community. Some questions to consider:

a. What kind of housing should be planned?

- Should housing fit into natural surroundings? (See, for example, magazine articles on places like Sea Ranch in California.)

- Individual one-family homes are the least efficient forms of housing in terms of ecology. What are the alternatives? Can you tell people that they cannot have private homes? Is it right to limit the number of single-family dwellings?

b. What will your policy be on growth--in industry and population?

- Again, the students will see that they encounter a conflict between individual rights and community planning. For example, is it fair to halt growth in suburbs? Does this then trap minority groups in urban ghettos?

c. Moving people and goods--how would you handle the problem of traffic flow?

- Measure traffic conditions now or ask for subjective accounts.

- If the class suggests remedies like mass transit, press them to decide what kind and find out where the money will come from.

d. How can you combine natural and built environment? What is the mixture now? What would be better?

(A good resource on this topic, with an unusual perspective is: Christopher D. Stone, *Should Trees Have Standing? Toward Legal Rights For Natural Objects,* Los Altos, Calif., Wm. Kaufmann, Inc. 1974.)

e. In *science* and *math* classes, measure current population growth and resource consumption rates. Make projections of future needs, say 20 years, for such items as

energy

fresh water

housing

transportation

schools

hospitals

services

4. An alternative is to use or develop a simulation.

a. To design your own simulation, define and assign roles: industrialists, retail merchants, outdoor enthusiasts, government officials, children, teen-agers, real estate developers, the elderly, and so on.

Pick a key issue relating to growth, express opinions, and try to read consensus.

b. Existing simulations on planning/growth issues include:

- Robert G. Hanvey. "Limits To Growth: A Role-Playing Activity," in Intercom #77. *Explorations in the Emergent Present*. Center for Global Perspectives, 1975. (Reprinted in the companion handbook to this guide.)
- *Urban Action: Planning For Change*. Lexington, Mass.: Ginn & Co., $208.00--includes multi-media components.
- *The Pollution Game*. Boston: Houghton-Mifflin, $9.00.

ADDITIONAL RESOURCES

Death and Life of Great American Cities. Jane Jacobs. Random House, Vintage Press, 1961.

City Planning. Environmental Education Center, 13 Veterans Drive, Oteen, North Carolina 28805.

Man's Environment -- How It May Be Improved. Central Washington State College, Ellensburg, Washington 98926.

Citizens Make the Difference. Citizen's Advisory Committee on Environmental Quality, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, 1973.

A Guide to Planning and Conducting Environmental Study Area Workshops. National Education Association, 1972.

"Suggestions for Community Participation in Environmental Studies," by R.F. Allen. *Journal of Geography*, October and December 1974.

"Human Ecology: The Interaction of Man with His Ecosystem," by H. Ishisaka. *Contemporary Education*, Winter 1975.

III. EXPLORING SPACESHIP EARTH

Viewing environmental concerns from a global perspective serves a number of important purposes. One outcome sought is an increased awareness of the complex webs of interdependencies which unite all corners of the planet. At the same time, the class should develop a clearer idea of how seemingly local issues or decisions are connected to global networks. Also, in viewing the planet as a whole, they can most clearly see that population is a key variable influencing all other environmental issues.

A. The Complexities of Interdependence

GOALS

- To realize that changes in one part of a system influence other parts of that system.

- To evaluate the effects of modern technology on humans and the environment.

1. After some field work or experimentation with such topics as ecosystems, food chains, and food webs, have students use individually assigned cases to illustrate this statement:

BIOLOGY

> "We see, then, that chains of plants and animals are not merely 'food chains,' but chains of dependency for a maze of services and competitions, of piracies and cooperations. This maze is complex; no efficiency engineer could blueprint the biotic organization of a single acre...."
>
> (Aldo and Luna Leopold, *Round River*, Oxford University Press, 1953, p.162)

2. Use individual or group assignments to explore the idea that changes made by humans in one part of a system can have far-reaching consequences.
   a. Volunteers might research the leaching of fertilizers or pesticides.
   b. Field trips to nearby streams or lakes can be used for analysis of water samples. Have the students then try to find the sources of contaminants--farms, factories, etc.

CHEMISTRY/ BIOLOGY

   c. Select examples of pollutants found at great distances from their known origins--oil and debris in the ocean, toxic substances in life forms in Antarctica, etc. Use maps to trace the influence of wind and water currents and food chains to demonstrate the potentially far-reaching effects of human-made changes in natural systems.
   d. Some of your students may find Frank Herbert's *Dune Trilogy*, New York: Berkeley Publishers, interesting. It depicts the "greening" of a hostile desert planet set in the remote future.

3. Some students could find out about current research in such areas as:
   a. human attempts to alter the climate;
   b. the possible effect of freon and supersonic aircraft on the ozone layer;
   c. environmental causes of cancer;
   d. the difficulty of disposing of nuclear wastes.

SOCIAL STUDIES

4. Use these research assignments as the basis for a social studies unit on the kinds of decisions we make about modern technology.

CONTEMPORARY ISSUES

a. For example, there is considerable debate over whether or not people should interfere with technological and scientific progress. Supersonic travel is here, many argue, and it can't be prevented.

b. Students should be encouraged to probe such issues from the perspective of sound scientific knowledge as well as their own feelings about the quality of life they want for themselves and future generations.

MULTI-DISCIPLINARY

c. In expressing their feelings about humans and their planet spaceship, students should feel free to make use of whatever media they feel comfortable with.

- For some, this may mean expressing themselves through poetry, songs, drama, short stories; others may want to put together a television documentary or drama; still others might want to approach the issues from the perspective of scientific knowledge and uncertainties.
- Once basic issues are understood according to ability levels and research, the expression of reactions should not be over-analyzed. It's important for students to feel free to vent their feelings as feelings--rather than respond to the necessity of writing a perfectly reasoned composition.

B. Population and the Quality of Life

GOALS

- To compare and contrast the ways people view the relationship between population growth and food supplies.
- To evaluate the present degree of economic development.
- To probe the effect on the environment of modern agricultural technology.

(For sample learning activities, see Unit I of the companion handbook to this guide.)

In addition to text and the handbook treatment of the subject, here are some special questions to explore:

1. How do people view the gap between population growth and food supplies?

   a. The perspective of have-not peoples on this issue can be explored both from a sociological and a humanistic approach.

LANGUAGE ARTS

LITERATURE

   (1) Students will quickly grasp the reasons for high population growth rates in the poor countries of the world: death control; the need for many children to help with work; cultural traditions; and so on.

   (2) It's also important to know how people's lives are affected by being trapped in these sociological facts. Books like *Nectar in a Sieve* by Kamala Markandaya (The John Day Co., 1954) or Oscar Lewis' *The Children of Sanchez* (Random House, 1961) are excellent for this purpose.

   Literary collections designed for high school use can provide a global survey of attitudes toward population/food problems. An excellent source is Gene and Barbara Dodds Stanford, eds., *Mix* in the Harcourt, Brace, Jovanovich New World Issues series, 1971.

   (3) Students might want to write about or discuss how the people they've encountered in their reading would respond to this statement in the Manchester Guardian:

   > "The news that a serious famine is building up in India has been slowly reported because at this time of year a degree of starvation is normal...."

   b. The attitudes of Americans can also be explored. It's important to be realistic about this. Little will be accomplished if students end up fighting guilt feelings every time they go to McDonald's. In fact, it can be argued that America's affluence actually spurs the economy of other countries and provides grain surpluses that have saved millions from starvation.

SOCIAL STUDIES

   (1) One objective approach is to find out how much aid America gives to other countries.

WORLD ISSUES

   Do other nations give more? (Yes--at least in terms of percentage of gross national product.)

CONTEMPORARY PROBLEMS

   The class might construct a carefully worded opinion poll on whether or not people feel more help should be given to the poor of the world.

MODERN U.S. HISTORY

   (2) Analyzing the value questions involved is important. Students should work toward clarifying their own values rather than blindly accepting someone else's.

Living in the world's richest nation presents certain dilemmas:

- Many feel that we've made it big because we've earned it. Others should also earn their rewards. There is also the position that aid should not be given to countries that refuse to try to control population growth rates.
- On the other hand, many leaders of poor countries feel that they're in a game with the cards stacked against them. A fair percentage of Americans agree.

Probing these viewpoints is complex and difficult. The most important thing to ask your students when such matters come up is to think things through.

2. Another loaded issue is that of the limits of growth. Even if population growth levels off, many experts question whether we can continue the present pace of economic development.

   See the handbook, unit II, for specific activities.

   In addition, useful ideas for teachers on this subject are contained in Robert G. Hanvey's *Explorations in the Emergent Present,* Intercom #77, Center for Global Perspectives, Winter 1975.

SCIENCE

3. Science classes can probe the possibilities provided by science and technology for closing the population food gap. Individual and/or group research could delve into such topics as:

   a. The successes and limitations of the Green Revolution.

   b. The ecological concerns arising from the need to increase irrigation, chemical fertilizers, and pesticides, and to develop new seed strains.

   c. The ability of some insects and bacteria to develop immunities to available pesticides.

MULTI-DISCIPLINARY

4. Building on work completed in a variety of courses, see if the students can support or modify the following statement, using specific examples:

   "Clearly the search for resources, and their exploitation must alter the ecosystems of the earth, in many cases beyond recognition. In general the more advanced the material culture the more drastic this alteration becomes. Agriculture under heavy population pressure is, however, as drastic a modifier as industrialization; the Yangtze delta* is as far from its pristine state as is the Delaware Valley--farther

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*A major farming region of China.

> in some ways. *Population pressure* is, in fact, the key element in the story. If numbers increase, all other problems magnify themselves."
>
> (Kenneth Hewitt and F. Kenneth Hare, *Man and Environment,* Association of American Geographers, 1973, p. 29.)

Some questions to use to deal with the quotation:

a. How does farming in America alter earth's ecosystems?

b. In what ways does growth of *world* population place pressure on American farming?

c. Why do the authors suggest that a farming region changes ecosystems nearly as drastically as industrial regions?

d. Would it be right to consider agricultural land as built (human-made) environment? Why or why not?

C. Measuring the Quality of Life

GOALS

- To classify factors which affect the quality of life.
- To observe that the factors affecting the quality of life do not have the same significance for everyone.

SOCIAL STUDIES

MODERN U.S. HISTORY

CONTEMPORARY ISSUES

1. It's hard to pin down precisely what we mean by the quality of life. Some social scientists have tried to establish criteria.*

a. A social studies (or science) class could try to determine its own criteria for measuring the quality of life in your community. You might start with something like this:

	Poor								Excellent	
	1	2	3	4	5	6	7	8	9	10
Air quality										
Water quality										
Services										
Recreation										
Cost of Living										
Employment										
Income (per capita)										
Housing										
Climate										

---

*For a study unit using measures designed in a survey for the Environmental Protection Agency, see Intercom #82, Center for Global Perspectives, July 1976.

b. Add other factors that ought to be considered. (The students may want social indicators--like race or sex equality--to be included.)

c. Poll the class and see where agreement lies; talk about areas of consensus and disagreement. The class might want to conduct this poll in the community. This will provide a fair sampling of public opinion about the community and should help clarify thinking about what "quality of life" means.

2. Measuring the intangibles.

LANGUAGE ARTS

LITERATURE

WRITING

ART

PHOTOGRAPHY

a. Other classes might explore the quality of life from different points of view. What are people's feelings? What could be better about the city or town? Would another environment (e.g., a rural area) be more satisfactory?

Are there some things that don't show up on your questionnaire? For example, perhaps people in other neighborhoods would have quite different feelings. (Local newspapers--including letters to the editor--will provide ideas about how others feel.)

b. One way to get into these intangibles is to read what people say about your or similar communities. What positive and negative expressions do you find in novels, poetry, songs, films, etc.

c. Encourage students to express their own feelings through whatever medium they choose.

A person using a camera, for example, can create a picture study of boredom, beauty, excitement, decay--whatever he or she feels.

D. The Oceans: A Special Case

GOALS

- To analyze the importance of the seas.
- To identify the problems associated with the claims for equitable distribution of the seas' wealth.

Few texts, even including those which emphasize environmental concerns, offer much information about the world's oceans--70 percent of the earth's surface and an essential portion of our endangered environmental systems. Teachers can put together their own units on this urgent topic, using outside readings and A-V kits. Science classes can provide important data for considering the social, political, economic and aesthetic consequences of human actions.

SCIENCE
BIOLOGY
EARTH SCIENCE

1. Laboratory work and text assignments can be used to determine the role of the oceans in the life support systems of Spaceship Earth.

   This should include the importance of oceans as sources of oxygen; as the habitat for countless varieties of plant and animal life; as a real and potential warehouse of minerals and foods.

LANGUAGE ARTS

2. Use myths, legends, historical accounts, poetry to consider the role the ocean has played in human history.

   a. Students will note the awe with which the oceans were once regarded--a source of wonder and fear.

   b. Contrast such views with items in news and business magazines about mining the ocean floor, conquering this last of earth's frontiers.

   c. Volunteers might want to write their own perspectives on this changing human attitude toward the seas.

SCIENCE
ECONOMICS
CONTEMPORARY ISSUES

3. Students should explore some of the estimates made about the oceans as a source of food and minerals--and their limitations.

   a. What are *manganese nodules*---what promise do they hold as suppliers of vital minerals? How soon will the technology to mine them be available?

   b. How much of the world's diet depends on food from the sea? What nations in particular rely on the oceans?

      - Are we overfishing? If so, what areas?

      - What new forms of ocean food are now being exploited? Do these developments present ecological dangers?

   c. What are the potentials for using ocean waves and tides as sources of energy?

   d. How are the oceans being polluted? What is the extent of the damage at present?

SOCIAL STUDIES
CONTEMPORARY ISSUES

4. The implication of human exploitation of the seas can best be approached from the question of whether or not the nations of the world can agree on rules before it's too late.

   a. Good sources for seeing the relationship between the oceans as resources and the need for a Law of the Sea can be found in recent issues of the *Smithsonian* magazine.

INTERNATIONAL RELATIONS

WORLD STUDIES

b. Simulating the debates at the Law of the Sea Conferences is a good way to get at some of the key issues, such as:

(1) How much of the seas should be controlled by coastal nations?

(2) How can overfishing be prevented?

(3) Who should mine the ocean floor--the nations with the technology (i.e., the rich countries) or should it be an international group, to provide some of the resources for *all* nations?

(4) Is there a fair way to enable the poor and landlocked countries to gain some of the food and minerals?

(5) What is likely to happen if there is no agreement on a Law of the Sea?

c. Good sources include:

- Henry Beston, *The Outermost House* (Ballantine, 1971) and Rachel Carson, *The Sea Around Us* (Mentor, 1954) both breathtakingly beautiful accounts of the intertwining of sea, sea creatures and the seasons from naturalists' perspectives.

- background reading in *Great Decisions, 1975* (Foreign Policy Association--includes teacher's guide).

ADDITIONAL RESOURCES

The History of Population Growth. Environmental Education Center, 13 Veterans Drive, Oteen, North Carolina 28805.

A Curriculum Activities Guide to Population and Environmental Studies. Project KARE. Institute of Environmental Education, 8911 Euclid Avenue, Cleveland Heights, Ohio 44106.

Focus: Population Control -- A Study of Social Conflict. Curriculum Innovations, Inc., 5454 Shore Drive, Chicago, Ill. 60615.

Operating Manual for Spaceship Earth. R. Buckminster Fuller. Pocket Books, 1970.

"Influence of Techology and Industrialization on Life Style," by K.N. Butler, *Journal of Health, Physical Education, Recreation*. November 1974.

Riches of the Sea. Jacques Cousteau. Abrams, 1975.

Law of the Seas: Oceanic Resources. Erwin B. Jones. Southern Methodist University Press, 1972.

IV. ACTIVITIES IN U.S. HISTORY

A. Population Changes and the Environment

GOAL

- To trace the influences of the built environment on the natural environment, as seen through the perspective of U.S. history.

From the moment the first settlers arrived in the New World, their activities began to alter natural systems. By the 19th century, Americans were replacing ever-increasing amounts of natural setting with built environment. In fact, one of the key adjustments facing people in the modern world has been to adapt to--and try to modify--their built environment.

1. One approach to studying the colonial period is to consider ways in which people were shaping and being shaped by their environment.

   a. Trace the history of the forest regions that covered much of the East.

   Note that settlers viewed these forests as both resources and obstacles--forests had to be cleared for settlement and for roads.

   (1) Ask the class why colonists didn't consider the danger of overexploiting this resource. (This will add emphasis to the view of the land as having limitless potential for growth and expansion.)

   (2) Using pictures, text accounts, and eyewitness descriptions have the class pick out ways Americans had altered the environment by 1800--even before the age of industry.

   - How did growing numbers contribute to these changes?

   - Why were so many eager to keep pushing into the wilderness?

WEST-WARD MOVE-MENT

2. Consider ways in which the westward movement contributed to changes in the environment. Some examples:

   a. Early settlers spoke of the skies being darkened by the flight of birds. What changed this?

   b. How did the laying of transcontinental rail lines interfere with ecosystems?

   c. What kinds of pollution problems were common in frontier towns? (poor water, sanitation, etc.)

d. What is a chilled stick plow? How did its invention alter the Great Plains? (made farming--and over-farming possible)

19th CENTURY INDUSTRIALIZATION

3. Urbanized and industrialized America. Questions to explore:

a. How did industrialization (and mechanized farming) make possible the growth of enormous cities?

- Use charts to compare city size from 1800 to the present.
- Note ways in which your own community fits into the historical patterns of settlement, industrialization, urbanization, the growth of suburbs. What evidence can the class find of each of these stages?

LANGUAGE ARTS

b. What new problems of adjustment did people have to face in cities?

AMERICAN LITERATURE -

- Use stories and first-hand accounts of the problems of adapting to an urban environment.
- Such themes as creating neighborhoods or feelings of alienation can be traced through to the present.
- The experiences of different groups also can be followed through literary sources--blacks moving from the south; Mexican-Americans moving into urban areas; immigrants from throughout the world. Each group represented shifts in population; each faced special problems of adjustment.

HISTORY

c. How did the work environment of Americans change?

LITERATURE

- Readings can be used to show the transformation from handcrafts and human farm labor to working with machines.
- Personalized accounts, from Samuel Gompers' autobiography to Studs Terkel's *Work*, are rich sources of people's views on their work environment.

WRITING

- Ask students to pick a job in any time period, try to imagine themselves engaged in it, and write a journal of their daily experiences and feelings.

MUSIC

- Compare work songs in different periods to note changes in the kinds of concerns people expressed through singing.

4. The development of suburbs and sprawling cities represents a largely 20th century development in creating built environment.

MODERN U.S. HISTORY

a. How did people adapt to the newer suburban environment? (e.g., automobiles gave mobility; they felt free of city congestion and problems.)

b. What problems have been created by the growth of suburbs? (automobile congestion and pollution, unplanned growth, etc.)

LANGUAGE ARTS

c. Use literary accounts to probe varying viewpoints on suburban America. For some it represents the ideal lifestyle; for others it is something quite different.

AMERICAN LITERATURE

d. What kinds of alternatives are emerging today?

- Newspapers and news magazines can be used to show recent migrations to the "sunbelt" states of the South and Southwest.

- Students can also explore the movement of many Americans, young and old, to rural areas or small villages.

WRITING

- Have the class write about their own futures--say 10-15 years from now. Where would they like to live and why? What kind of lifestyle do they envisage? To what extent are their choices influenced by shifts in population? (e.g., If no one else was moving "back to the land," would they do it anyhow?)

B. American Viewpoints on the Natural Environment

GOALS

- To trace the development of the preservation and exploitation of the natural environment, as seen through U.S. history.

- To identify examples in the different media of environmental exploitation and preservation.

Students should see two concurrent threads throughout the nation's history relating to attitudes toward the environment.

AMERICAN HISTORY

First, there has always been a respect for, and love of, the open spaces, the beauty and cleanliness of the land, the richness and variety of the landscape.

Second, we have viewed the natural environment as territory to be conquered and as resources to be exploited.

LANGUAGE ARTS

1. Trace the development of these two contradictory themes throughout U.S. history, using art, journals, and history texts.

LITERATURE

ART

a. How did early settlers view the land? What were their impressions in terms of resources and possibilities; in terms of scenic beauty?

Accounts of early explorers, like the journals of Captain John Smith, are good for this. So are early paintings and sketches.

b. How were the two sets of attitudes evidenced in the westward movement?

- In what ways did natural elements pose obstacles?
- How were these obstacles overcome? (e.g., railroad made travel easier)

Journals of early frontiersmen like Daniel Boone and Davy Crockett are good sources. Compare these with newspaper ads offering free or cheap land to be developed.

c. How did the Industrial Revolution influence attitudes toward the natural environment?

You might contrast the stories of great mining, railroad or industrial empires with the warnings issued by Thoreau, Muir, and others.

2. Look for signs of the two attitudes today.

Consider local attitudes, those involving the entire nation; and attitudes about the world environment.

a. Newspaper articles, usually centering around particular issues like saving or harvesting the California redwoods, would make a revealing bulletin board display.

b. Similarly, you can have students make displays or slide shows of attitudes expressed in magazine advertising. Note that some ads (like the Caterpillar ads about intelligent decisions, or Atlantic-Richfield's The Real and The Ideal) recognize both points of view.

MULTI-DISCIPLINARY 3. Encourage students to express their own viewpoints in whatever way they choose--poems, songs, editorials, re-writing ads, creating posters, etc.

ADDITIONAL RESOURCES

"Teaching American Environmental History," by D.H. Strong. *The Social Studies*, October 1974.

Ekistics; An Introduction to the Science of Human Settlements. Constantinos Doxiadis. Oxford University Press, 1968.

"Environmental Education from a Historical Perspective," by T.C. Moon and B. Brezinski. *Social Science and Mathematics*, May 1974.

Options: A Study Guide to Population and the American Future. The Population Reference Bureau, Inc., 1755 Massachusetts Avenue, NW., Washington, D.C. 20036.

Growth and Future of Cities. Everett S. Lee. Center for Information on America, Box C, Washington, Conn. 06793.

The American Population Debate. Daniel Callahan, ed. Doubleday, 1971.

Man and Nature in America. Arthur A. Ekirch, Jr. University of Nebraska Press, 1973.

V. STUDYING OTHER CULTURES OR WORLD REGIONS

The study of culture is a vital aspect of environmental education. As students learn about the nature of culture, they come to see it as the combination of patterns humans have devised in order to adapt to their environment. When they are immersed in the customs and beliefs of other peoples, they gain new insights into their own culture; in fact, many anthropologists have said that the major benefit of studying other cultures is to gain better understanding of one's own. These studies will also add to awareness of ways in which all societies on our planet are involved in the same population/environmental concerns.

A. Comparing Cultures

GOALS

- To compare and contrast the effect different cultures have on the environment.
- To identify ways in which cultures interact with one another.
- To describe ways in which human-environmental interactions are expressed.

In the study of any culture or region, here are some questions and topics to explore:

1. In what ways does culture determine how the people will use and change their environment?

BIOLOGY
GEOGRAPHY

a. Science classes can be used for a special introduction into the ecosystems of the region--or regions like it (rain forests, deserts, savannahs, etc.).

EARTH SCIENCE

- Special attention should be given to how plants and animals have adapted to the environment.

- This will offer important ideas for comparison in considering the role of culture in human adaptation.

SOCIAL STUDIES

b. How do other societies--in the same or similar environments--differ in their patterns for adaptation? For example, if you are studying nomadic peoples in North Africa, note how others use and alter the environment in different ways.

c. In adapting to environmental conditions how do the people change their surroundings? Note that planting crops or digging a well represents changing surroundings.

2. Culture can be thought of as learned ways of adapting to the environment. How do changes in culture create changes in surroundings?

a. The growth of cities in Afghanistan, for example, creates more built environment and requires new ways of adapting.

b. Another example: In Japan, how does space influence culture?

- As population density increased, the people of Japan developed new culture patterns--e.g., farming methods, housing, standards of etiquette.

ART

POETRY

- These same influences (space and density) are reflected in art and poetry.

(See, for example, Issa, *A Few Flies and I: Haiku by Issa,* N.Y.: Pantheon Books, 1969.)

3. Explore interactions between cultures--and reasons for them.

a. Today, even the simplest cultures have some contact with the outside world; this is the beginning of interdependence between cultures.

LANGUAGE ARTS

LITERATURE

A good case study can be developed by having the class read *Pitcairn's Island,* the third book of Nordhoff and Hall's *The Bounty Trilogy.*

- What elements of Polynesian culture did the mutineers use to adapt to the new island? What elements of English culture were used?

- That culture exists today and has been studied by anthropologists--check the index of the *National Geographic.*

b. In many such societies, the class will find a mix of traditional patterns and contact with more modernized societies for purposes of trade, entertainment, etc.

c. How do these contacts alter human-environment interactions? (e.g., New tools create new ways of altering or controlling surroundings; transistors offer new perspectives and hopes.)

ART

LITERATURE

4. How do people express their feelings about human-environmental interactions?

   a. Read legends or myths for ideas about how people of a particular culture respond to their surroundings. Records or tapes of oral tradition are also useful.

   b. The class can explore ways that beliefs reflect the society's ways of adapting to the environment.

      - For example, religious ceremonies and customs serve a purpose--they are peoples' ways of seeking spiritual aid in meeting their needs or explaining the unknown.

      - Invite the class to speculate on the origins of particular beliefs and customs.

      - Try comparing these with folk beliefs in American culture--good luck charms, etc.

   c. How are beliefs and customs influenced by the environment? (i.e., some groups pray for rain; others for less flooding etc.)

   d. Have students bring in magazine ads that reflect American values and beliefs about human-environment interactions. These should include built and natural environment. Use these for comparison with the culture being studied.

SOCIAL STUDIES

5. All parts of a culture interact. Ask the class to point out examples of how change in one part of a culture can lead to changes in other parts.

   a. For example, in a developing country, how do new ways of working influence the family, learning, language, customs and beliefs?

   b. An account of the uneven and often confusing changes in one culture is Beth Roy's *Bullock Carts and Motor Bikes: Ancient India on a New Road* (Atheneum Publishers, 1972).

6. If a society includes a number of sub-cultures or separate cultures (e.g., Indian tribes and settled towns in a Latin American country; Bedouin nomads and growing cities in Arab countries) what kind of interdependence develops? (Usually some form of trade that benefits both groups.)

   Does this interdependence lead to understanding or friendship? (Often not, each group will still consider its life style superior.)

B. Modernization

GOALS

- To probe the effects of modernization on culture, environment, and growth rates.
- To realize that modernization fosters greater interdependence among the world's systems.

1. How does the introduction of modern technology create both changes in the environment and changes in culture?

SOCIAL STUDIES

   a. Environmental changes are likely to include more and different kinds of built environment plus tools and techniques for altering natural environment.

   This might be traced from the beginnings of contact with the industrialized West.

   b. How do these changes influence the culture? (All aspects of culture are likely to feel the impact.)

   c. What conflicts emerge from the arrival of modern technology? That is, are there tensions and clashes between tradition and change?

   In addition to text accounts, outside readings will be valuable. For example: Jo Ann White, ed., *African Views of the West* (N.Y., Julian Messner, 1972) contains poetry and first-hand accounts of African responses to Western influence.

2. Notice that modernization also brings increased interaction with other parts of the world.

   a. How does this influence cultural changes? (Consider, for example, the kinds of music, dress, entertainment, etc. that becomes popular.)

   b. Is the relationship with other cultures equal or unequal. Many developing countries find they have little leverage in dealings with developed countries. They are unequal partners. Will this change as industrialized nations increasingly need the resources of the developing nations?

LANGUAGE ARTS

3. Divide the class into two groups. Have one group write journals or impressions on the theme of what they have in common with young people in a simple culture. Have the other group do the same with young people in a modernizing nation.

WRITING

4. Modernization and environmental issues

   a. Have the students role-play being members of a governing or planning group for a developing country.

b. Provide them with specific issues to decide. Examples:

- Foreign governments providing vital aid want you to control pollution. This will slow economic growth. What will you do?
- How fast is the population of the country growing? How fast is food production increasing? What can you do to provide a better diet for all people in the society?
- An opposition party is opposed to modernization. They argue that traditional values are being lost. They are gaining strength. How will you deal with them?

c. Students should try to be realistic in confronting these issues. Try to have them maintain the perspective of the culture they are role-playing.

Be sure they consider obstacles to decisions. For example, if they decide population growth rate should be slowed, ask what problems stand in the way and how they intend to overcome them.

5. Modernization and population growth rates

a. In developing countries, what factors have contributed to high population growth rates?

b. How does rapid population growth interfere with efforts to modernize? (The Aswan High Dam in Egypt makes a good case study--an ambitious and costly project to increase farmland, when completed, the agricultural benefits barely kept pace with population growth.)

c. Why do some countries have difficulty increasing food production? (e.g., modern methods might not be suitable for the terrain.)

d. Incidentally, most texts will point out that American mechanized farming is highly efficient--one farmer can feed many people. You might have the students challenge this. Have them find out how many people are needed to support the farmer with machinery, fertilizer, irrigation, transportation, pesticides, gasoline, etc. This will provide an interesting comparison between farm efficiency in the U.S. compared to that of labor-intensive countries.

ADDITIONAL RESOURCES

Fieldstaff Perspectives: The Impact of Population Problems on Society. American Universities Field Staff. Hanover, New Hampshire, 1971.

Teaching Population Geography: An Inter-Disciplinary Ecological Approach. George W. Carey and Julie Schwartzberg. Columbia University, New York: Teachers College Press, 1969.

Population. Valerie K. Oppenheimer. Headline Series, The Foreign Policy Association, 1971.

"Technological Revolutions: Some Implications for the Social Studies," by P.W. Kane. *The Social Studies*, January 1975.

Culture in Process. Alan R. Beals. Holt, Rinehart, & Winston, Inc., 1967.

The Study of Anthropology. Pertti J. Pelto. Charles E. Merrill Publishing Co., 1965.

Man and the Ecosphere: Readings from The Scientific American. W.H. Freeman and Co., 1971.

VI. ENVIRONMENTAL ISSUES: THE LOCAL COMMUNITY AND THE GLOBAL COMMUNITY

A. Lifestyles and the Impact of Global Systems

GOAL

- To observe ways in which global interdependence affects living conditions.

A major goal of environmental education is to develop awareness that the kinds of lives your students lead, now and in the future, are influenced by the complex webs of interdependence they have been learning about. Here are some suggestions for making this idea more real to your class.

1. Have the students find out how people in particular jobs are influenced by events and decisions far removed from their community.

    a. Read the following excerpt to the class. It is from a 1975 speech by Thomas E. Gish at Southern Illinois University. He's editor and publisher of *The Mountain Eagle*, a small newspaper in the coal mining town of Whitesburg, Kentucky.

    "The miner has a vital stake in day-to-day developments that affect coal. The Mideast oil situation, the ups and downs of the steel industry, the demand for electricity--all these and many other factors have a direct bearing on whether the miner works three days or one day or five days a week."

Outside events and the policies of coal companies have combined to create the following situation, according to Gish:

"The end result has been that the Central Appalachian area where I am from is one of the leading poverty centers in the entire country. Incomes average less than half the national average. The education system is the worst in the nation. More than a third of the housing is classified as sub-standard. The creeks and hollows are filled with maimed and broken people. The hillsides are being gutted by strip mines, and the creeks are filling with rock and mud. If there is any place in the United States that is a total mess, it is the Appalachian coal fields."

b. Have students, in pairs or groups, find how lives of people in your community are influenced by events far away. (The influences are not likely to lead to results as dramatic as those Gish describes.)

c. Another way to approach this would be to find out how interdependence influences those performing specific tasks--some of which are likely to be found in your region. Examples:

- Detroit auto workers
- lumber workers
- wheat farmers
- aircraft employees in Los Angeles
- shoemakers in New England
- space workers in Houston

2. An alternative approach to seeing the impact of global interdependence is to ask students to trace ways an event in one part of the planet will have far-reaching consequences.

a. Example: Poor grain harvests in the USSR between 1972 and 1975 led to the purchase of large amounts of grain from the U.S.

b. Using the *Reader's Guide to Periodical Literature*, have students find out how this affected--or seemed to affect--such things as:

(1) food prices in the U.S.;

(2) labor unions and dock workers;

(3) the food situation in desperately poor countries;

(4) grain farmers in the U.S. and in other grain-exporting countries (Canada, Australia, New Zealand);

(5) grain wholesalers and international shipping interests;

(6) inflation in England or Japan (which import a high percentage of their food supply).

(7) Building on this last point, another kind of question to consider would be: how could this influence the price you pay for a stereo, transistor or bicycle? (Goods produced in Japan would rise in price if Japan has inflation.)

B. Urbanization and Globalization

GOALS

- To identify ways in which cities throughout the world are interdependent.
- To recognize the similarities of cities throughout the world.

SOCIAL STUDIES

WORLD STUDIES

CONTEMPORARY ISSUES

The planet is becoming urbanized and industrialized. Both processes relate people more and more to other parts of the world. And both are changing the way people live and the environments they live in. Dramatically. People who lived in tribal settlements or farmed the land as their ancestors had done for centuries are suddenly thrust into factory jobs or shanty towns or congested urban centers that bear a closer resemblance to New York or London than to their society's traditional life.

1. How do cities reflect, and contribute to, global interdependence?

   a. What are the reasons for cities? How do they tie into global systems?

   b. Explore these questions by finding how your own community is linked to other parts of the globe.

   The Mershon Center at Ohio State University has developed ways of showing the surprising number of ties between one American city and global networks, in a project called *Columbus and The World.* Ideas on how to apply this to your own community can be found in William Nesbitt and Andrea Karls, *Teaching Interdependence: Exploring Global Challenges Through Data,* Intercom #78, Center for Global Perspectives, Summer 1975.

2. In what ways do cities develop a sameness?

   a. Put together--or have the students do it--a picture study or slide show of cities around the world. Ask where they think the city is. The similarities

b. Ask the class to consider the implications of the following in terms of what may be happening to human diversity:

(1) An ad in the international issue of *Time* said that the magazine's readers have more in common with each other than with their fellow countrymen. See if the students can relate this idea to the picture study.

(2) Writing about the *simplification* or *homogenization* of cities, two geographers write:

> "The basic automobile, whether made in Tokyo, Detroit, or Hamburg, must function in essentially the same way in Alaska, Alabama, the Sonoran desert, the Rockies, and Panama.... The tourist, businessman, or diplomat, scurrying around the globe with brief stopovers, is quite incapable of adapting to all the diversity of food, water, custom, and language. These are, therefore, to be simplified into one basic package."

(Kenneth Hewitt and F. Kenneth Hare, *Man and Environment*, Association of American Geographers, 1973.)

MULTI-DISCIPLINARY

3. Develop a multi-disciplinary unit of city environments around the world. Students might work in teams on particular cities or on specific tasks.

a. Use stories, readings, diaries, films, photographs of city life; contrast business areas with slums or shanty-towns.

Look for material that details life and presents it in readable and dramatic form. These should include hopes and successes as well as burdens and struggles.

b. Some questions and ideas to consider:

(1) What is the environment of the person or people you learned about? How would you describe it to someone else?

(2) Prepare a report of your impressions of the city or barrio or factory, etc. Why are people moving there? What signs of hope exist in the midst of problems?

- How do people make use of what the environment provides?
- Encourage students to be imaginative and creative in their reports--using photographs, slides, art, poetry (their own or others), newspapers, etc.

c. Compare reports on as many cities as you studied. Look for answers to such questions as;

(1) What problems do all or most cities share?

(2) What kinds of attitudes do people seem to have about their surroundings?

(3) Compare what you've learned with what you know of city life in the U.S. What's similar? What's different?

(4) Do you find people caught in problems between the old and the new? Are segments of American society in a similar situation (American Indians, Chicanos, Puerto Ricans, etc.)?

(5) What kinds of adjustments do people have to make when they move from rural areas to cities?

d. Conclusion: to bring together the students' thoughts and reactions, have them consider the following statement by economist Barbara Ward:

> "Urbanization is the symbol of the non-natural environment which is becoming the daily habitat of nearly the entire human race, an environment that we *have* to keep but also *have* to make human or else it will destroy us."

- What does the class think Barbara Ward means in saying we must make cities more human?

- Do the students have ideas about what should be done and how we might try it?

C. Efforts to Deal with Earth as a Single System

GOALS

- To evaluate global efforts to deal with worldwide problems.

- To examine divergent points of view concerning global issues.

Once students have examined some of the details illustrating our close worldwide interdependence, they should deal with some of the efforts to cope with global concerns on a global level.

SOCIAL STUDIES

1. Units on the work of the U.N. would be particularly important on this topic.

Consider particularly the "functional" activities of the U.N.--the efforts to deal with human problems like poverty and hunger. Groups could prepare lively reports on what is being done by such groups as the World Health Organization, UNESCO, Food and Agriculture

Organization, etc. Rather than dry statistical reports, encourage the groups to gather information and then answer questions from the class about the kinds of work they, as FAO members (or whatever) have been engaged in.

2. World conferences are also becoming increasingly important--attempts to deal on a global basis with such concerns as food, population, environment, the oceans, and development.

   a. The conferences are good bases for role-playing activities--using magazine research to find out the position of particular countries on key issues and the reasons for those positions.

   b. A well-planned role-playing session will give the class insight into the global nature of our crises and the difficulties created by differing perspectives on these crises.

3. Exploring the viewpoints of others. Extremely useful lessons can be built on such topics as the following:

   a. *Population growth*--probe the reasons for the often bitter disagreement over whether or not the population growth rate is the key environmental issue.

      (1) Some see population as a concern of the rich at the expense of the poor.

      For example, a Michigan politician expressed the fear that only the educated and affluent will see the need to have smaller families. The poor, he said, would continue to grow in numbers. "The population growth in America's slums, where the welfare population resides, is explosive."

      (Richard Fiske, quoted in
      M. Piburn, *The Environment: A Human Crises,* p. 23.)

      (2) Others, including many minority group leaders, feel that the call for curbs on population growth is a way for the rich to keep the poor and minority groups from gaining large enough numbers to assume greater political power.

      (3) Others argue that population is not the issue. This viewpoint is expressed in the following statement by India's Prime Minister, Indira Gandhi:

      "It is an oversimplification to blame all the world's problems on increasing population. Countries with but a small fraction of the world population consume the bulk of the world's production of minerals, fossil fuels, and so on.... On the one hand,

> the rich look askance at our continuing poverty--on the other hand, they warn us against their own methods. We do not wish to impoverish the environment any further and yet we cannot for a moment forget the grim poverty of large numbers of people."

Encourage the class to examine these and other examples of conflicting viewpoints on the issue. It will help them to see that (a) the value conflict can be a barrier to action; (b) other people believe their attitudes and values (which may be very different from your students' values) are valid.

b. *Other environmental issues*

A similar conflict of viewpoints makes it difficult for the world's people to cooperate in solving world environmental problems. As with population, part of the controversy stems from the differing perspectives of rich and poor.

Using outside research, you might have the class put together a television documentary (a script or actual video tape) presenting opposing viewpoints on environmental issues. Here are two statements of position to start with:

Richard Hatcher, black mayor of Gary, Indiana:

> "The nation's concern with environment has done what George Wallace was unable to do: distract the nation from the human problems of black and brown Americans."

The late U Thant, in a 1969 speech:

> "I do not wish to seem overdramatic, but I can only conclude from the information that is available to me as Secretary-General [of the U.N.] that the members of the United Nations have perhaps ten years left in which to subordinate their ancient quarrels and launch a global partnership to curb the arms race, to improve the human environment, to defuse the population explosion, and to supply the required momentum to world development efforts."

The very act of research and trying to decide what to include or exclude from the documentary will provide the students with a worthwhile experience in examining values.

ADDITIONAL RESOURCES

"Remapping Our World," by R.B. Fuller. *Today's Education*, November 1971.

"Global Environment," by E. Keller. *American Biology Teacher*, February 1975.

The United Nations and the Population Question. Michael Carder and Richard Symonds. McGraw-Hill, 1973.

Cities. A Scientific American Book. Alfred A. Knopf, 1972.

Only One Earth: The Care and Maintenance of a Small Planet. Barbara Ward and René Dubos. W.W. Norton & Co., 1972.

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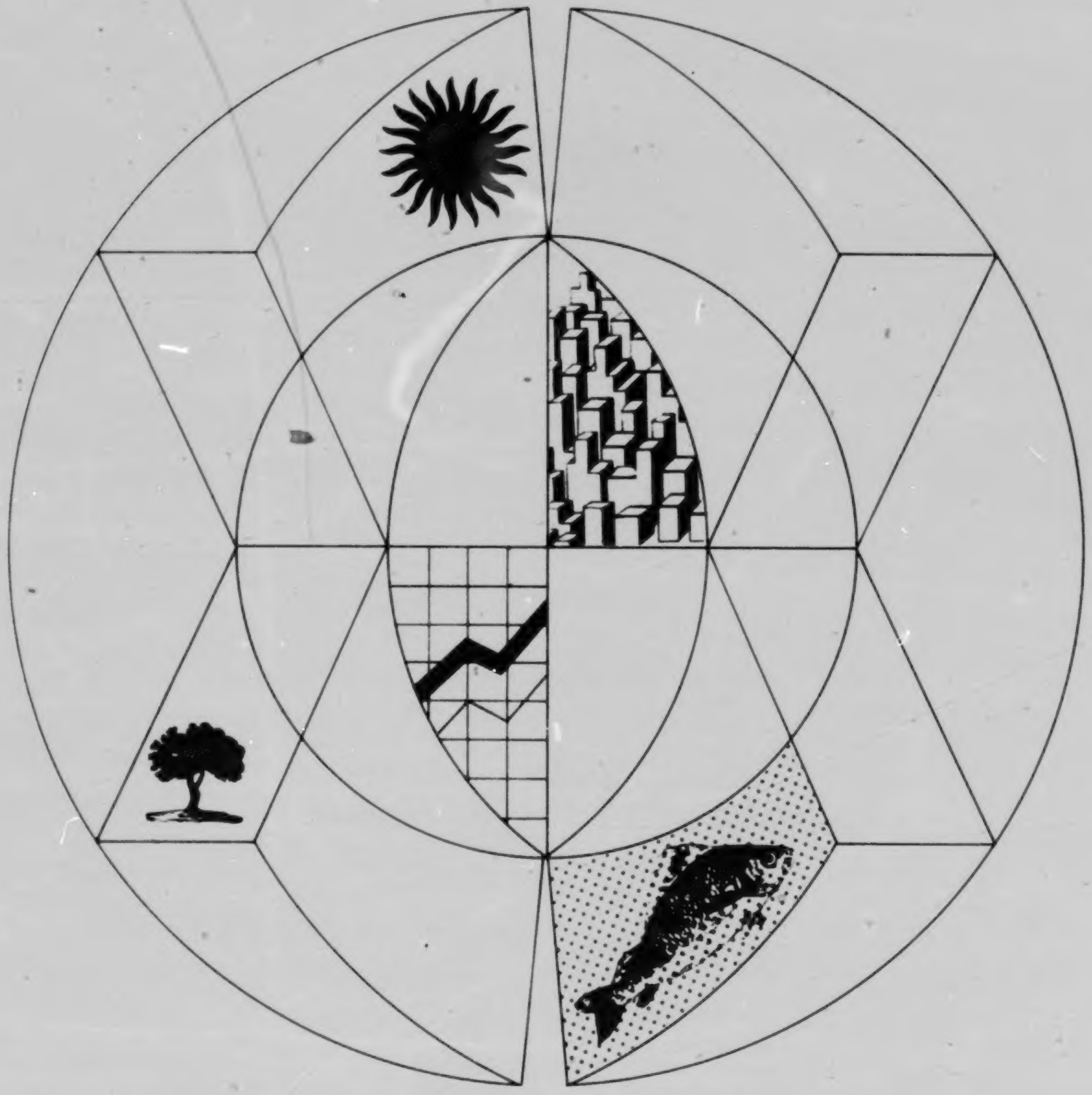
Part D
10-12 Handbook



Environmental Education
Interdependence: A Concept Approach

CENTER FOR GLOBAL PERSPECTIVES

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ENVIRONMENTAL EDUCATION

INTERDEPENDENCE: A CONCEPT APPROACH

HANDBOOK HIGH SCHOOL GRADES 10-12

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UNIT I: WE MAY ALL BE IN THIS TOGETHER,
BUT AREN'T THERE TOO MANY OF US?

FOR TEACHERS

INTRODUCTION

The activities in this unit explore population as the key variable in all environmental issues. The health of both the natural and built environment depends on how well we manage and plan for such population changes. The distribution of population, for example, is a major factor in the decay or resurgence of inner cities, in the sprawl or controlled growth of suburbs, in the misuse or preservation of resources and wilderness areas. The same is true on a worldwide scale. The quality of life of the passengers of Spaceship Earth will depend on our ability to cope with population including, besides changes in distribution, the unprecedented growth in numbers which has characterized this century.

UNIT OUTLINE

The lessons in this unit should be used in sequence. Each can be completed in one or two class periods.

Lesson 1: Measuring Population Growth

Subject Areas

- Social Studies
  - History
  - Current Events
  - Sociology
  - Area or World Studies
- Mathematics
- Science
  - Biology

Lesson 2: Personal Choices and Population Growth

Subject Areas

- Social Studies
  - History
  - Current Events
  - Economics
  - Sociology
  - Area or World Studies
- Language Arts
  - Writing
  - Journalism

Lesson 3: The Concerned Citizens

Subject Areas

Social Studies	Language Arts
Economics	Mathematics
Current Events	

Lesson 4: Conflicting Viewpoints: The Food Issue

Subject Areas

Social Studies	Language Arts
Current Events	Writing
World or Area Studies	Journalism

STRATEGIES AND OBJECTIVES

LESSON 1: MEASURING POPULATION GROWTH

In this lesson, the class will be working with the statistics of population growth -- birth, death, and growth rates -- and interpreting data on charts and graphs. Depending on the kind of mathematics the students are taking, that course might be the best place for most of the work. However, students in any course can work out the computations if they have achieved basic math skills.

Social Studies teachers may want to concentrate on chart interpretation, comparing data to information about a culture or region being studied, or having students find out more about the work of demographers. The *Explorations* activity can be used for class reports, role-playing, or written essays to evaluate students' ability to work with the data.

GOALS

1. To recognize that population influences all other environmental issues.
2. To recognize that a healthier environment depends on people making difficult choices and carefully measuring the consequences of their choices.

LEARNING OBJECTIVES

Students will

Knowledge

1. infer from charts and graphs the growth rate of particular populations and the world as a whole;
2. identify "death control" as a key factor in the rapid growth of world population;
3. recognize that population growth rate is related to food problems;

Skills

1. use mathematics skills to determine birth, death, and growth rates;
2. use charts and graphs to determine situations in which there would be zero or negative population growth;

Awareness

1. indicate increased awareness of population as a major factor in human/environment interactions;
2. recognize the need to understand population patterns to understand our world;

Interest

1. raise questions about how population patterns may affect their own lives.

ANSWERS AND POSSIBLE ANSWERS

A. Population Growth Questions

1. 17 18.7 13.5	2a. b.r. 23 d.r. 9 natural increase 1.4
	2b. -1 g.r. = 1.3
3a. 2,344,900 3b. 1,791,900	4. Nigeria 1.47 million Dahomey 70,180

B. Population for Selected Countries

1. Death rate and birth rate would be the same if there were no migration. The rates could be high or low, so long as they cancel each other out.
2. Germany, Hungary, Sweden
3. Kuwait, Colombia
4. Death rate is higher than birth rate, emigration could also be a factor.

Explorations

Students should notice that both per capita gross national product and growth rate are important factors. Some may notice that poor countries have higher death rates and higher percentages of children. The growth rate is important, because it suggests the country is likely to become poorer with more people.

The class will see by the chart that the major element in the increased population of poor countries is the declining death rate. Birth rate has also fallen, but not fast enough to avoid rapid growth.

C. Doubling Time

1. 35 years
2. 78.8 million
3. The doubling time will increase.
4. It helps indicate the future pressure on space and food.
5. When they reach child-bearing age, the growth rate is likely to increase.

LESSON 2: PERSONAL DECISIONS AND POPULATION GROWTH

By inquiring into personal decisions about family size, the class will be dealing with what is called the *demographic transition*, although we have not labeled it as such here. The theory is that, as countries become industralized and living standards rise, people will begin to have smaller families. Children in modernized societies are costly to raise and educate; in poor or traditional societies, large families were common for at least two reasons: many offspring died in childhood; and children are needed to help with work or growing food.

You might point out to the class that it took a long time for most developed countries to slow down population growth rates. As late as the 1950s, the U.S. growth rate was nearly as high as that of India. Developing countries are still struggling to modernize; many experts feel that, as they succeed and living standards rise, people will simply decide to have smaller families.

Teachers of area or culture studies should find the lesson useful in providing insights into the difficulties many societies face in the struggle for better living standards. In U.S.-related courses, you can also gain an important perspective on how personal decisions will affect population patterns in this country. Language arts classes can make use of the readings for comparing writing styles, particularly the importance of letter writing in early U.S. history and also the style of a good journalist in the *New York Times* selection.

GOALS

1. To recognize that population and other environmental issues involve deep conflicts of interest and viewpoint.
2. To understand that culture determines the variety of ways humans adapt to and alter their surroundings.
3. To recognize that a healthier environment depends on people making difficult choices and carefully measuring consequences.

LEARNING OBJECTIVES

Students will

Knowledge

1. identify economic factors that contribute to personal decisions about family size;
2. recognize that improved living standards and industrialization usually contribute to lower population growth rates;
3. indicate understanding that the costs of raising children in modern societies are only one factor in determining family size;

Skills

1. evaluate a letter, a family budget, and journalistic accounts to determine factors influencing family size;
2. compare the reasons for large families in colonial America with modern India;
3. hypothesize about how, during their own life times, family-size decisions might influence environmental conditions and food resources;

Awareness

1. develop awareness that people in poor or traditional societies have very real reasons for choosing to have large families;
2. recognize that the collection of decisions by individual families will determine future population patterns;

Motivation

1. demonstrate empathy for people struggling with such forces as economic and physical survival;
2. recognize that their own future lifestyles will in part depend on decisions other people make about family size.

ANSWERS AND POSSIBLE ANSWERS

Readings 1 and 2

1. In both India and colonial America the loss of many children led people to have larger families in the hope some would survive. For India, Jha mentions that children can help with work and

provide insurance for the parents when they are too old to work. Students should infer that the same idea would probably apply in colonial America.

2. Improved health, longer life expectancy, and fewer childhood deaths mean that more children survive to adulthood. This would encourage smaller families. This would apply even if the U.S. remained rural. Also, students should infer that improved living standards and mechanized farming, mean that children were not needed as much for farm work.

3. A higher standard of living might mean fewer childhood deaths and less need for children to work. Jha also points out that children become an expense as living standards rise. In anticipation of the next reading, you might ask the class if children are an expense in the U.S. today and whether or not this might contribute to decisions to have fewer children.

Reading 3

Less than $2,000 is left for savings, vacation and entertainment. College costs will vary. The students will probably suggest that if Francis and Maria live at home and attend a local college, costs could be kept down. (They would still be at least $1,000 per year.) The Sanchez's might have to borrow for college costs.

If two more children are added, the costs of food, clothing, medical and school expenses will increase. Most important, a college or vocational education becomes more difficult. Ramon and Gloria may decide to have more children because they like having children and want a large family. You may want volunteers to discuss their situation in terms of finding the money for college plans. In economics, career education, or home economics classes, you might want to have students check the Sanchez budget. Is it realistic? Does it reflect conditions in your community? What figures might be added or altered?

Reading 4

1. Both families have a struggle making ends meet, the Penhas, more than the Sanchez's. Raising children costs money, and in both cases, the mothers can't add to family income because any wages they would earn would not equal child-care costs. Note that Mr. Penha plans to have his son work as soon as possible.

2. The question is open. Brazilian workers could decide to have large families for non-economic reasons; or, they might feel children could help earn money. On the other hand, children's costs have to be paid for at least fourteen years, even if no high school education is planned. This, plus the desire to have their children receive an education, might lead to a decision for smaller families.

Explorations

Student speculations can be used for formal or informal hypothesis formation. You might want the students to work in small groups to make their predictions. These can then be checked against evidence encountered in Lessons 3 and 4.

LESSON 3: THE CONCERNED CITIZENS

In this case study we ask students to project themselves a little into their own futures and to consider the questions of: population in relation to quality of life; and the effects of U.S. population, even growing at a reduced rate, on the total resources of the world. The choices we have made and continue to make will determine the problems of the present and the prospects for the future. The students will each soon be in situations similar to that of the Clarks. The basic question is whether they will continue making the traditional decisions, or whether there is a desire to make, or the weight of problems will force, different choices.

The case of the Clark family can be used for individual research and writing assignments or you may prefer to have your students work in pairs or small groups.

The first part of this case can be completed within a single class period if the students speculate on the basis of the data in the tables. If you would like them to encounter more factual evidence, and gain experience in measuring the dimensions of population problems as they relate to the environment as well as in weighing the validity of sources and statistics, a one-day research assignment can be added. Have the class (or smaller groups) find data on such questions as: How much solid waste material is produced by each American each day? What is the automobile population of the U.S.? How fast is it growing? What percentage of air pollution is attributable to motor vehicles? What is the per capita consumption of energy or resources in the U.S. compared to a developing nation such as India? How much fresh water is used by an average American each day?

They could carry this a step further and try to determine to what extent anti-pollution regulations and technological innovations have reduced pollution and the pressure of population on resources.

Even without additional research, the class will have no difficulty listing how this ecology-minded family continues to contribute to pollution. The students should also grasp the point that since industrialized societies (especially the U.S.) have a much higher rate of consumption than do developing nations, population growth in such countries, even at a reduced rate, is part of the total population problem of the world. Of course, increased consumption can also occur without increased population growth. Furthermore, students should consider what kind of impact a rapid decline in U.S. consumption would have on developing nations which sell to the United States.

In the report or essay assignment, the students will probably suggest such changes as: selling the outboard (or trading it for a sailboat); getting rid of one car and using public transportation; perhaps getting rid of the gas-fired barbecue. The automobile would represent the greatest change in lifestyle. Students might also suggest other changes like reducing power consumption by using appliances less, perhaps also making adjustments in purchases and food consumption (i.e., consuming less).

Explorations

The students will probably notice that the Clark's contribution to pollution would be less if they were a two-child family rather than three-child. The greater the population, the more serious the strain on resources and the environment, *unless* other things also change. E.g., technological innovations or altered lifestyles could also contribute to reducing environmental problems.

GOALS

1. To know that the quality of life of individuals is increasingly influenced by world-wide interdependence.

2. To recognize that population influences all other environmental issues.

3. To develop the skills which enable individuals to express their personal feelings about human-environment concerns.

LEARNING OBJECTIVES

Students will

Knowledge

1. consider the effects of U.S. population, though growing at a reduced rate, on the world's resources.

Skills

1. use charts to draw inferences on how individual lifestyles contribute to pollution problems.

2. analyze and develop a program that encourages environmental conservation.

Awareness

1. recognize that the problems of the present and the prospects for the future are pretty much the result of choices we have made and are making today.

Motivation

1. project themselves into the future and make their own choices and decisions about population and the quality of life.

LESSON 4: CONFLICTING VIEWPOINTS: THE FOOD ISSUE

The material in this lesson can help students understand the gravity of the world's food problem -- both now and in the future. There are wide areas of disagreement over how serious the problem is and whether or not the planet can support an ever increasing population. While the students aren't likely to come up with firm conclusions, they will gain practice in weighing contradictory evidence and arguments. This is particularly valuable in light of the fact that most of our ideas on this subject come from mass media sources which tend to highlight only the dramatic and tragic elements.

Outside research should be encouraged -- The Foreign Policy Association's *Great Decisions* and *Headline* programs would be useful sources for good readers. In evaluating essays, you should note particularly how each student manages to handle the conflicting arguments.

GOALS

1. To recognize that population influences all other environmental issues.
2. To recognize that population and other environmental issues involve deep conflicts of interest and viewpoint.

LEARNING OBJECTIVES

Students will

Knowledge

1. identify conflicting arguments about the world food problems;
2. recognize that most experts agree there *is* a problem, but disagree over its severity and solutions;

Skills

1. evaluate conflicting evidence and opinions;

Awareness

1. recognize that statements on the food problem by experts -- or by the mass media -- are open to varying interpretations;

Motivation

1. indicate awareness of the need to understand more about the problem and how it will influence their lives.

UNIT I: WE MAY ALL BE IN THIS TOGETHER

BUT AREN'T THERE TOO MANY OF US?

TO THE STUDENT

The population of the world is approaching the four billion mark. It has doubled in the past 35 years, and by the end of the century the passengers on Spaceship Earth will number well over six billion.

What do these numbers mean to your own life and to what your future will be like? Can the planet provide enough food and resources for six billion people? Some people argue that we are reaching the *limits of growth* -- our numbers place such a strain on food supplies and the life support systems that we simply cannot afford many more people or continued economic growth. Others feel that earth can support far greater numbers, and support them comfortably. One United Nations estimate says that 12 billion people could live on the planet.

Who is right? Are we in an age of constant scarcity, in which many will suffer from malnutrition and starvation? Will Americans have to make do with a less luxurious lifestyle? Or are we in position to solve the problem of world hunger? Will science and technology show us the way to provide all people with a decent standard of living? The answers will have a lot to do with how you live, the kind of lifestyle you can look forward to, the comfort, luxuries, and security that will be available to you.

Over the next few days, you will be looking at these questions in more detail. You won't find any final answers. But you are likely to have a better idea of what the possibilities are.

LESSON 1: MEASURING POPULATION GROWTH*

A. The first step is to get a better idea of how fast the population is growing and whether it will continue to "explode" during your lifetime. This means analyzing some of the forces and personal decisions that contribute to population growth. Then we can use that information to explore how population might influence the quality of your life -- now and in the future.

Demographers -- experts who study population patterns -- refer to birth, death, and growth *rates*, rather than to total numbers. Rates are used because the numbers themselves do not give a clear picture.

---

*Adapted from: *Teaching About Population.* INTERCOM #72, Center for War/Peace Studies, May 1973.

If 200,000 births are recorded in one country and 80,000 in another, you can't really tell which has a higher birth rate. Rates are computed per 1000 people in a population. The first country might have a birth rate of 17 and the second of 35. That makes the birth rate in the second country much higher although the numbers are lower.

The formulas for computing rates is simple:

$$\text{death rate} = \frac{\text{number of deaths in a year}}{\text{population}} \times 1{,}000$$

$$\text{birth rate} = \frac{\text{number of live births in a year}}{\text{population}} \times 1{,}000$$

For example, if a country had a population of 600,000 and a recorded death rate of 20,000 in one year, its death rate would be

$$\frac{600{,}000}{20{,}000} \times 1{,}000 = 30 \text{ deaths per } 1{,}000 \text{ population}$$

What would its birth rate be if there were 30,000 births in one year?

To establish *growth* rate -- how fast a population is growing, subtract the death rate from the birth rate. Growth rate is usually stated in percentages, so you simply divide by ten to get a figure in hundreds -- like this:

$$\text{Rate of natural increase} = \frac{\text{birth rate - death rate}}{10}$$

(You would also have to figure in migration, since population can be raised or lowered by people moving in or out.)

Here are some problems to practice on.

1. In 1970, the population of Thomasville was 40,000. 680 children were born in 1970, 760 in 1971, and 560 in 1972. Determine the birth rate for each of the three years.

$$\frac{680}{40{,}000} \times 1000 =$$

$$\frac{760}{40{,}680} \times 1000 =$$

$$\frac{560}{41{,}440} \times 1000 =$$

2. *a.* In Whale's Neck, population 55,000, 1,265 children were born in 1972 and 495 people died. Compute the birth and death rates and the rate of natural increase.

$$\frac{1265}{55{,}000} \times 1000 =$$

$$\frac{495}{55{,}000} \times 1000 =$$

$$\frac{23-9}{10} =$$

b. During the same year in Whale's Neck, 110 people moved away and 55 people moved to the town. Use this additional information to determine the growth rate of the town.

$$\frac{55-110}{55{,}000} \times 1000 = \qquad g.r. = \frac{(23-9)\ -1}{10} =$$

3. Mexico has an annual birth rate of 43 and a death rate of 10. Its population is 54,300,000.

a. Determine the approximate number of children that would be born in a year.

$$\frac{43}{1000} \times 54{,}300{,}000 =$$

b. Determine the increase in Mexico's total population size at the end of one year.

$$\frac{(\text{births} - \text{deaths})}{1000} \times \text{population} =$$

4. Two African nations, Nigeria and Dahomey, have the same growth rate, 2.6. Nigeria's population is 56.5 million (56,500,000), while Dahomey's is 2.8 million (2,800,000). How many more people will be living in each country after a year's time?

Nigeria 56.5 × .026 =
Dahomey 2.8 × .026 =

B. Study the chart, "Population Information for Selected Countries".

Use the chart to answer the following:

1. Describe the relationship between birth rate and death rate (excluding migration) if a country were to have zero population growth.

2. Which three countries are closest to zero population growth?

3. Which two countries have the highest growth rates?

4. In what situation would there be a negative growth rate?

POPULATION INFORMATION FOR SELECTED COUNTRIES

REGION or COUNTRY	Population Estimates Mid-1972 (millions)	Annual Births per 1,000 Population	Annual Deaths per 1,000 Population	Annual Rate of Population Growth (percent)	Number of Years to Double Population	Population Projections to 1985 (millions)	Annual Deaths to Infants under One Year of Age per 1,000 Live Births	Population under 15 Years (percent)	Population over 64 Years (percent)	Percent of Population in Cities of 100,000+	Per Capita Gross National Product (US $)
WORLD	**3,782**	**33**	**13**	**2.0**	**35**	**4,933**	**—**	**37**	**5**	**23**	**—**
AFRICA											
Egypt	35.9	44	16	2.8	25	52.3	118	43	L	31	160
Ethiopia	26.2	46	25	2.1	33	35.7	—	44	L	3	P
Ghana	9.6	47	18	2.9	24	14.9	122	45	L	18	190
Kenya	11.6	48	18	3.0	23	17.9	—	46	L	7	130
Libya	2.0	46	16	3.1	23	3.1	—	44	5	26	1,510
Nigeria	58.0	50	25	2.6	27	84.7	—	43	L	7	P
Senegal	4.1	46	22	2.4	29	5.8	—	42	L	15	200
South Africa	21.1	41	17	2.4	29	29.7	138	40	L	32	710
Namibia (Southwest Africa)	0.7	44	25	2.0	35	0.9	—	40	5	N.A.	
Zaire (Dem. Rep. Congo)	18.3	44	23	2.1	33	25.8	115	42	L	7	P
ASIA											
Burma	29.1	40	17	2.3	30	39.2	—	40	L	7	P
China (People's Republic of)	786.1	30	13	1.7	41	964.6	—	—	—	14	P
China (Republic of)	14.7	28	5	2.3	30	19.4	18	43	L	38	300
India	584.8	42	17	2.5	28	807.6	139	42	L	10	110
Indonesia	128.7	47	19	2.9	24	183.8	125	44	L	12	100
Israel	3.0	27	7	2.4	29	4.0	23	33	7	55	1,570
Japan	106.0	19	7	1.2	58	121.3	13	24	7	55	1,430
Kuwait	0.8	43	7	8.2	9	2.4	39	38	L	59	3,320
Laos	3.1	42	17	2.5	28	4.4	—	—	—	7	110
Pakistan	146.6	51	18	3.3	21	224.2	142	45	L	10	110
Syria	6.6	48	15	3.3	21	10.5	—	47	L	31	260
Turkey	37.6	40	15	2.5	28	52.8	119	42	L	18	350
THE AMERICAS											
Argentina	25.0	22	9	1.5	47	29.6	58	30	7	61	1,060
Brazil	98.4	38	10	2.8	25	142.6	—	43	L	34	270
Canada	22.2	17.5	7.3	1.7	41	27.3	19.3	30	8	49	2,650
Colombia	22.9	44	11	3.4	21	35.6	76	47	L	35	290
Cuba	8.7	27	8	1.9	37	11.0	48	31	6	31	280
Guatemala	5.4	43	17	2.6	27	7.9	92	46	L	15	350
Mexico	54.3	43	10	3.3	21	84.4	69	46	L	21	580
Peru	14.5	42	11	3.1	23	21.6	72	45	L	22	330
United States	209.2	17.3	9.3	1.0	70	246.3	19.2	29	10	58	4,240
EUROPE											
Czechoslovakia	14.9	15.8	11.4	0.5	139	16.2	22.1	24	11	16	1,370
France	51.9	16.7	10.6	0.7	99	57.6	15.1	25	13	40	2,460
Germany (Federal Republic of)	59.2	13.3	11.7	0.2	347	62.3	23.6	25	12	54	2,190
Greece	9.0	16.3	8.3	0.8	87	9.7	29.3	25	10	34	840
Hungary	10.4	14.7	11.7	0.3	231	11.0	35.9	21	11	24	1,100
Italy	54.5	16.8	9.7	0.7	99	60.0	29.2	24	10	29	1,400
Netherlands	13.3	18.4	8.4	1.0	70	15.3	12.7	27	10	45	1,760
Poland	33.7	16.8	8.2	0.9	77	38.2	33.2	28	8	31	940
Spain	33.9	19.6	8.5	1.0	70	38.1	27.9	28	9	33	820
Sweden	8.2	13.7	9.9	0.4	174	8.8	11.7	21	13	33	2,920
United Kingdom	56.6	16.2	11.7	0.5	139	61.8	18.4	24	13	71	1,890
USSR	2[illegible]3	17.4	8.2	0.9	77	286.9	24.4	28	8	31	1,200
OCEANIA											
Australia	13.0	20.5	9.0	1.9	37	17.0	17.9	29	8	65	2,300

Source: 1972 World Population Data Sheet, Population Reference Bureau, Inc. Reprinted with permission.

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L = Estimated to be less than 5 percent.
P = Estimated to be less than US $100.
N.A. = Not applicable: country has no urban community over 100,000.
— = Unavailable or unreliable.

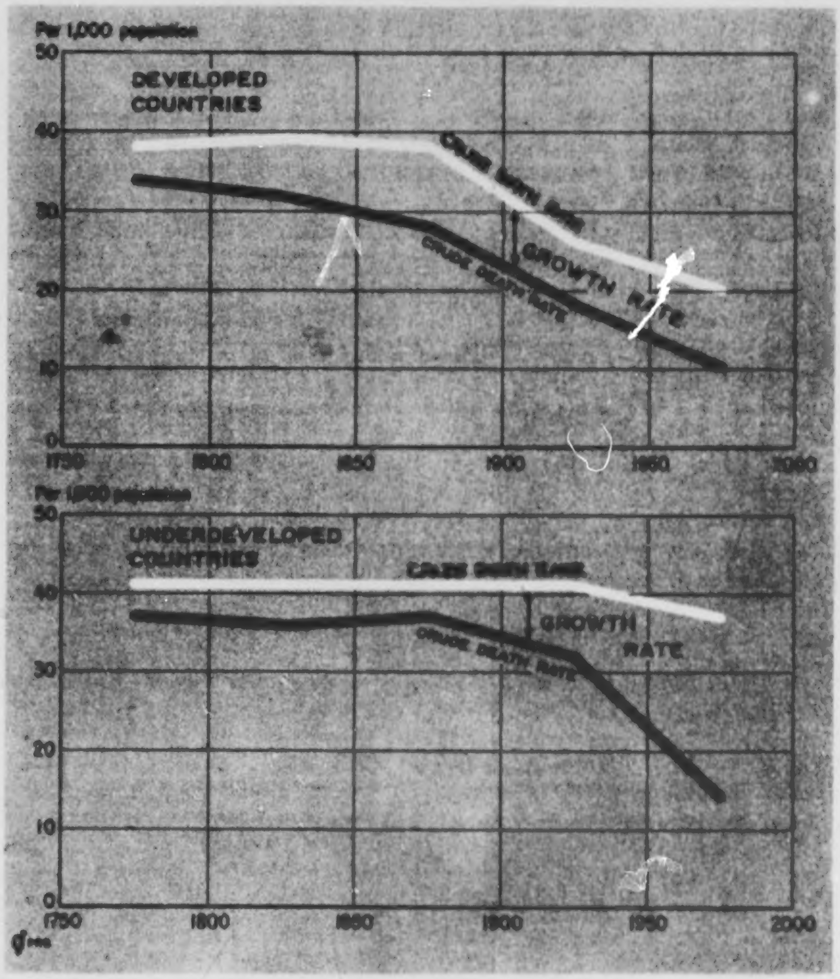
EXPLORATIONS

Suppose you were a demographer reporting to a congressional committee considering food aid to the most desperately poor countries in the world. What information on the chart would you want them to notice? Why would growth rates be important in your report on the world's population?

After your report, one congressperson notes that it is the poorest countries that have the highest growth rates. He states: "The problem is that the birth rate in those countries keeps going up. That's why they grow so fast!"

Is he right or wrong? Explain how you would use the following chart to respond to his statement. Does the chart also help explain why developing countries have a higher growth rate than developed nations? Explain.

ESTIMATED BIRTH AND DEATH RATES, 1770-1970



SOURCE: "Man's Population Predicament," *Population Bulletin*, April 1971, © 1971 by Population Reference Bureau. Reprinted with permission.

C. Another way to look at population growth is to ask how long it will take a population to double, assuming it is increasing at a constant rate. Doubling time is very significant because it illustrates how a small annual increase can make a major change in absolute numbers in a relatively short period of time.

Population increases on the same principle as compound interest in a savings account. With each increase the base number rises; the next increase, while the same percentage of the base, is a higher numerical figure. For example, if a number increases by 1% each time, it will take 70 increments to double the original number. At 2%, the number will grow twice as fast and double in only 35 increments. Thus the population of a nation growing at the rate of 1% a year will double in 70 years, at 2% in 35 years, at 2.5% in 28 years. In other words, by dividing the number 70 by the growth rate, you can determine a population's doubling time. (This formula is substantially correct as long as the growth rates are under 10%.)

Problems

1. Growing at a rate of 2%, how long will it take to double the population of Deer Park, population 1000?
2. In 1971, the Philippines had a population of 39.4 million and it is growing at a rate of 2.8% a year. If growth continues at the present rate, determine the estimated population in 25 years.
3. Look back to the chart, "Population Information for Selected Countries." Since the chart was published in 1972, growth rate in the U.S. has dropped to 0.6%. How will this change the doubling time?
4. In a country with limited space or farm land, why is doubling time important?
5. Having a large percentage of the population under age 15 may have an influence on doubling time. Why?

LESSON 2: PERSONAL DECISIONS AND POPULATION GROWTH

Several factors lead to changes in population growth rates. One major force has been the advance in science and health over the past century. A great many diseases and epidemics have been successfully overcome, while the magnitude of others has been reduced. Combined with better sanitation practices and improved nutrition, the result has been what is called *death control.* The death rate in all areas of the world is decreasing dramatically. This means that even if the birth rate remains the same, the population will grow.

Another element in determining growth rates is the kind of decisions individuals make about family size. In any given time, in any given culture, people may decide to have large families or small families. Many elements are involved in these decisions -- personal and societal customs and beliefs, tradition, cultural sanctions which offer rewards or criticism for large families or small, and so on. For example, in China, the world's most populous country, the government has made a vigorous effort to slow the growth rate. People now marry in their late twenties. A couple that married at age 18 or 20 would be severely criticized -- if not prevented -- by their neighborhood or village group.

Read the following short selections. All describe factors, often largely economic, which help determine whether a family will have many children or few. As you read, look for answers to this question:

> For what reasons would the people involved be likely to choose to have a large or a small family?

Reading 1: Family Size in Colonial America

The year is 1775. The American colonies are engaged in conflict with Great Britain, the struggle that became the American Revolution. Battles have already been fought and hundreds of people have been killed.

John and Abigail Adams find themselves caught up in the struggle -- John is a delegate to the Continental Congress meeting in Philadelphia; Abigail raises and educates the children, manages the farm, and prepares for an expected British attack. Against this background, she wrote the following letter to John:

> Dearest Friend   Braintree Sepbr. 25 1775
>
> I set down with a heavy Heart to write to you. I have had no other since you left me. Woe follows Woe and one affliction treads upon the heal of an other. My distress for my own family having in some measure abated; tis excited anew upon the distress of my dear Mother. Her kindness brought her to see me every day when I was ill and our little Tommy. She has taken the disorder and lies so bad that we have little hopes of her Recovery. She is possess'd with the Idea that she shall not recover, and I fear it will prove but too true.

In this Town the distemper seems to have abated. We have none now so bad as Patty. She has lain 21 days, each day we had reason to think would be her last, but (a) good Constitution, and youth for ought I know will finally conquer the distemper. She is not able to get out of Bed, nor can she help herself any more than a new born infant. Yet their are symptoms which now appear in her favour.

The desolation of War is not so distressing as the Havock made by the pestilence. Some poor parents are mourning the loss of 3, 4 and 5 children, and some families are wholy striped of every Member.

Wherefore is it that we are thus contended with? How much reason have I for thankfulness that all my family are spaired whilst so many others are striped of their parents, their children, their husbands.

O kind Heaven spair my parents, spair my Dearest Friend and grant him Health. Continue the lives and health of our dear children. Sister Elihu Adams lost her youngest child last night with this disorder. I can add no more than Supplications for your welfare, and an ardent desire to hear from you by every opportunity. It will alleviate every trouble thro which it may be my Lot to pass. I am most affectionately your distress'd Portia

[her "secret" name with John]

Reading 2: Modern India

"Where there is a certain degree of prosperity, every family has a motivation not to have too many kids because an extra kid means an erosion of the family standard of living. It means an outlay for an extra cot, for schooling, bus fares, etc. But when you go to the very poorer parts of India the response to the same family planning facilities is very much smaller because an extra child which sprawls on the . . . floor, goes about naked and hungry does not erode the family standard of living . . . . In fact, there appears to be a faint hope and insurance for the old age of the parents if it may happen to be one of the children who may survive and get a job or till the soil. So to find the real answer to the problem of rising population one should concentrate not only on the (spread) of family planning techniques but also on an improvement in the standard of living of the people . . . ."

(L. K. Jha, "India's Role in the World Today," *India News*, Jan. 15, 1971)

FOR DISCUSSION

1. What similarities do you see in reasons for having large families in the poor areas of India and in colonial America?

2. What changes in American society do you think have led to smaller families? For example, if the U.S. were still largely a nation of farmers, would large families still be the rule? What other factors are involved?

3. Why does Jha feel that a higher standard of living would persuade people to have smaller families?

Reading 3: Measuring the Cost of Raising Children

Ramon and Gloria Sanchez live in East Los Angeles. They own their own home, a modest adobe house in a mixed business and residential neighborhood. Ramon earns $14,000 a year as a maintenance worker. They have two children, Maria, 10, and Francis, 15.

The family budget looks something like this:

mortgage and interest payments	$ 2850
food	2500
clothing	1000
medical expenses and insurance	1200
car payments and insurance	1280
utilities and telephone	600
taxes -- state, federal and property	1800
house and car repairs	300
school expenses (bus, books, etc.)	270
color TV payments (one year only)	360
	$12,560

How much is left over for savings, entertainment and recreation? Both Maria and Francis would like to go to college. How much do you think this will cost? Where will the money come from?

Now suppose the Sanchez's decide to have two more children. What costs will increase? What is the likelihood of sending four children to college or vocational school? Describe how their standard of living will be changed by having more children.

On the basis of the family's economics, are they likely to have two more children? What other factors might enter into their decision?

Reading 4: Urban Life in a Developing Nation

While about half the world's people live in small rural villages, cities are experiencing revolutionary growth in all countries. For some, urban life means good jobs and prosperity -- factors that may cause people to decide to have fewer children. For others, the city offers struggle and poverty. For the urban poor, what happens to traditional customs of having large families? For example, who will help with the work and provide old-age insurance for the parents.

Look for answers in this reading.

. . . The 'Brazilian [Economic] Miracle,' as it is called by its advocates, appears to have left behind many working-class people even here in the Greater Sao Paulo area, where economic growth has been most pronounced.

Jose Salvador Penha is one of those. When Mr. Penha woke up to begin another working day recently, it was pitch black outside.

His wife and three children were still asleep in the back room, which is crudely separated from the rest of the house by a curtain. Quietly he picked up a wash basin filled with water that had dripped from the roof during a heavy overnight rain. After splashing his face, he heated coffee and buttered several slices of bread.

The rain had churned the path from his house to the paved highway into a bog. So Mr. Penha rolled up his trousers, held his shoes aloft and splashed through the red mud to the bus stop.

After two lengthy busrides, he arrived at his factory in Sao Paulo at 7 A.M. to begin his shift as a metal cutter. Working overtime, he left the factory at 8 P.M., and it was close to 11 P.M. when he arrived home. His dinner was on the kerosene stove waiting to be reheated. His wife and three children again were asleep in the back room . . . .

In recent years Sao Paulo has . . . been the fastest-growing major city in the world. There are nine million people in the metropolitan area, and the annual population increase is about 500,000. Most of the newcomers are migrants from the interior, like Mr. Penha, drawn by the prospect of industrial jobs . . . .

Mr. Penha is better off than many workers. With overtime, his monthly salary is about $110, which is almost twice the minimum wage.

But after paying $24 a month in rent and spending 50 cents a day on bus fares, he finds that there is hardly enough to feed his family an almost meatless diet.

"I am working harder than I ever did," said Mr. Penha. "But I have the feeling that I am not any better off than I was a few years ago. . . . My wife does not work because she could not earn more than it would cost to hire someone to take care of the children. . . ."

Mr. Penha is planning to make his oldest boy work when he reaches 14 in three years instead of letting him continue in school.

"I can't wait for him to get through school," he explained. "He may not get a better job than I have, but I need him now."

There are no available statistics on family income, but the most recent ones kept by the trade unions are not heartening. They show that a blue-collar family with two working members in 1969 -- five years after the military take-over -- was earning 9 percent less in real income than a family with only one working member in 1959. . . .

(Jonathan Kandell, "Brazil's Economic 'Miracle' Appears of Little Benefit to the Workers," *The New York Times*, Jan. 25, 1976, p. 3. © 1976 The New York Times Company. Reprinted by permission.)

FOR DISCUSSION

1. How does the situation of the Penha family compare with that of the Sanchez's?

2. Do you think economic pressures will lead Brazilian workers to have smaller families? Why or why not?

Language Arts & Journalism Classes:

- The reading about Mr. Penha is an excerpt of a much longer article. The author devotes most of the column to factual statements such as those in the last paragraph. Why do you think he wove in the story about Mr. Penha?

- Find examples of other newspaper articles which you feel do a good job of combining factual information with interesting narrative.

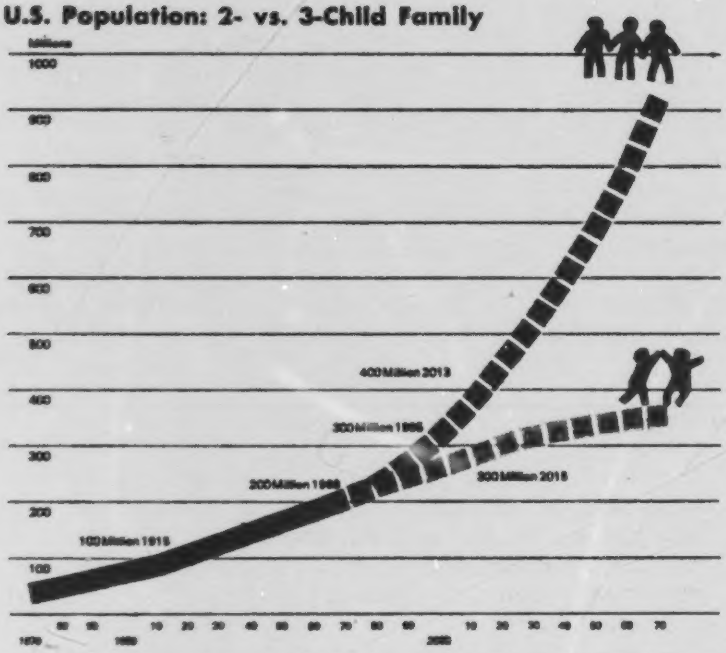
EXPLORATIONS

How will decisions about family size influence population in this country and the world? How do you think changes in population will affect:

1. the quality of life in the U.S.? Consider, for example, environmental pollution, urban growth, wilderness areas, and traffic congestion;

2. the ability of the world's people to grow enough food to feed a population that increases by 80 million people per year?

Make some guesses about those questions. The following chart may help. You will be exploring these questions further in the next two lessons.



U.S. Population: 2- vs. 3-Child Family

Source: *Population and the American Future*, The Report of the Commission on Population Growth and the American Future

LESSON 3: THE CONCERNED CITIZENS*

Scenario

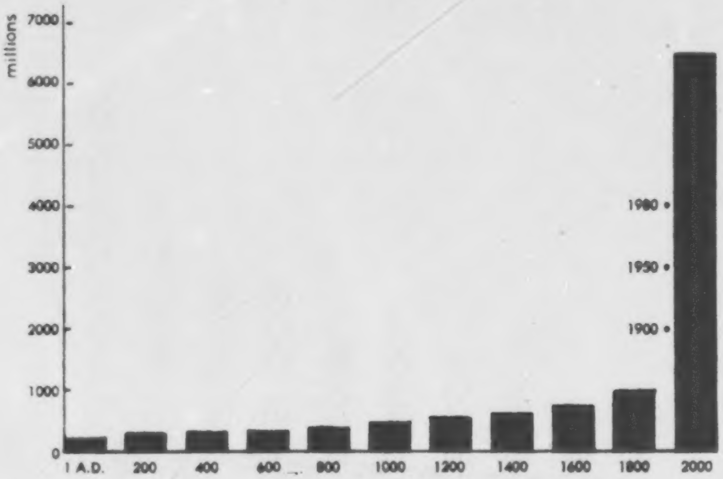
George and Elaine Clark might be considered a typical modern (1985) couple. George is an electronics engineer, Elaine a social worker; their two small children are in grade school. They own their own home in a pleasant suburb, with 1½ acres of land, a portion of which is used for a vegetable garden. They have two cars, one used by Elaine in her work. Their home is comfortable but not unusually well furnished; in fact, the lawn mower, deep freeze, gas-fired barbecue, and color television are all recent acquisitions still being paid for. The Clarks enjoy varied types of recreation: walking, camping, tennis, golf, picnics, swimming, and boating (they purchased their own outboard two years ago).

Both are active citizens and much concerned with doing their part to save the community's environment—they are members of an ecology group and have discovered a number of activities that are ecologically sound and require very little time or effort. The garden is a case in point—by growing some of their own food, they save money, enjoy the hobby, and make good use of their land, while reducing their dependence on overpackaged foods. They recycle tin and aluminum cans, bottles, and newspapers. They avoid the open burning of trash, and use grass and leaves (and even coffee grounds) for a compost pile.

Discussion

George and Elaine are more involved in protecting the environment than most people, but is it enough? Have they really helped to curb pollution and the pressures of population on resources? In what ways do they contribute to environmental problems? Try figuring out, on the basis of a typical week, in precisely what ways they are polluters. The following data may help you to consider the Clarks' life style and its effects on environment and resources.

World Population: 1 A.D.-2000 A.D.



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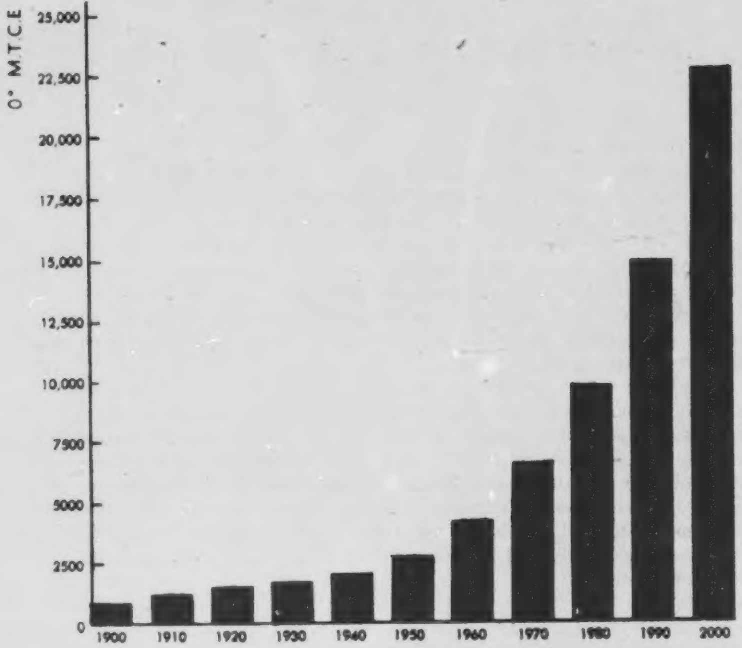
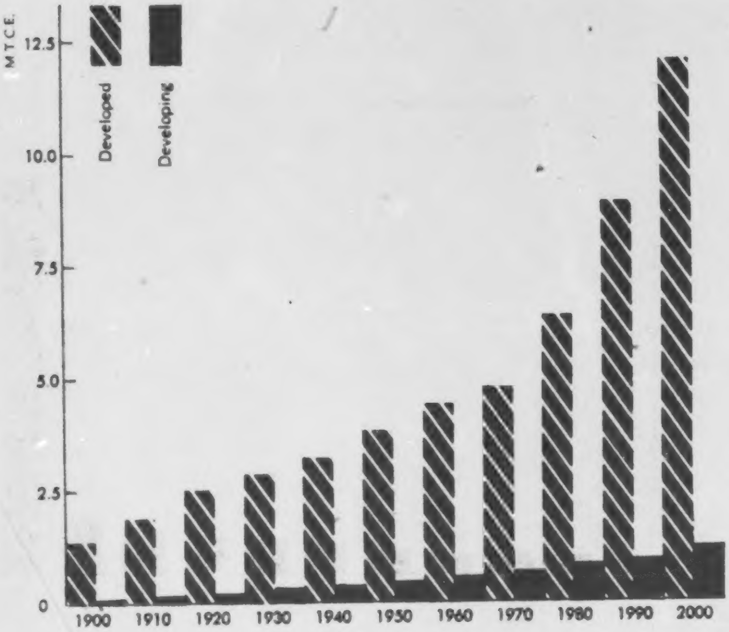
* Excerpted from "*Quality of Life: Three Case Studies on Live Styles and Ecology*," by David C. King, and reprinted in INTERCOM #72, May 1973.

World Energy Consumption: 1900-2000 A.D.
In Millions of Metric Tons of Coal Equivalent



Note: U. S. percentage of world population: 5.5%. U. S. percentage of world use of raw materials (not including food): 40.0%

Developed and Developing Countries Energy Consumption Per Capita
In Metric Tons of Coal Equivalent



Source of three charts: United Nations.

ASSIGNMENT

In class reports or an essay, see if you can revise George and Elaine's living patterns so that their contribution to environmental problems is reduced. You might plan out a week's activities to see what can be changed. If changes are made, how do they affect the Clark's lifestyle? If they can't be made does this mean there is little hope for preserving the environment?

EXPLORATIONS

Go back to the predictions or guesses you made at the end of Lesson 2. Has work with Lesson 3 modified your predictions in any way? If so, how? Suppose, for example, the year for the scenario were 2001, instead of 1985. Would decisions about family size have a bearing on how much George and Elaine contribute to pollution?

Considering the charts you have been working with, what predictions would you make if, over the next 50 years, the rest of the world achieved living standards comparable to those of the U.S.? What would the benefits be? What potential problems would occur?

LESSON 4: CONFLICTING VIEWPOINTS: THE FOOD ISSUE

The world's population *increases* at the rate of over 200,000 people per day. At that rate, how long does it take for the world population to increase by the size of your community?

Can world food production keep up? Millions of people are now suffering from malnutrition or are seriously undernourished. Is it possible to feed the present population? And if it is, can we keep increasing food production to provide for 200,000 new humans every day?

There are no clear answers to these questions. In fact, experts widely disagree -- as you will see. Your assignment, after reading the selections, is to write a balanced essay on the world food situation. Incorporate both positive and negative predictions. If you reach a conclusion, explain how you arrived at it.

Outside research is optional.

Viewpoint 1: We Are Losing the War Against Hunger

Norman Borlaug is a plant pathologist who was in large part responsible for the Green Revolution -- the development of new strains of wheat and rice which have contributed to a dramatic increase in grain production -- a basic food. In 1970, he was awarded the Nobel Peace Prize for his work.

Despite the successes of the Green Revolution, Borlaug raises warnings. Here are samples of his statements:

> The Green Revolution has won a temporary success in man's war against hunger and deprivation. It has given man a breathing space. If fully implemented, the Revolution can provide sufficient food for sustenance during the next three decades. But the frightening power of human reproduction must also be curbed. . . .
>
> To talk about food without talking about population growth is nonsense. Every year 80 million more people come into the world, and every year we have to grow 27 to 30 million metric tons more food than we did the year before to feed the new mouths. . . ."
>
> (Speech to Nobel Prize Committee)

Dr. Georg Borgstrom, food science professor at Michigan State University is even more pessimistic:

> There are 1200 million well-nourished or adequately nourished people on the globe. Then there are the rest -- 2,500 million people who are underfed or malnourished.

> We have a severely hungry planet. . . . People are still convinced that some great technological trick will solve the problem. . . .
>
> There are limits to the land. Half the world's farmable land of about 7.9 billion acres is already under cultivation. Claiming more will be expensive -- perhaps as much as $5,000 an acre and that may be dangerous. There has already been critical destruction of vital watersheds and ecosystems with the result that the world deserts have grown five times in size. . . .
>
> (Interview with Tom Tiede, NEA, quoted in *The Berkeley Daily Gazette*, 1/1/74, p. 1, 2)

Viewpoint 2: We Can Solve the Food Problem

Lester R. Brown is a specialist on world food problems. He views the Green Revolution as offering tremendous hope for winning the struggle against hunger. However, since the following statement was made, he has qualified his position somewhat. The new strains of seed require large amounts of water and chemical fertilizer. This is a major problem because the fertilizers, being petroleum based, have become very costly and increasingly scarce.

> [For many people] the outstanding technological achievement of this generation was the recent landing on the moon by astronauts Armstrong and Aldrin. But for the one billion Asians for whom rice is the staple food, the development of IR-8 one of the new strains . . . is a more meaningful achievement. It is literally helping to fill hundreds of millions of rice bowls once only half full. For those for whom hunger is a way of life, technology can offer no greater reward. Population growth and food production in this region, containing more than half the world's people, were on a collision course. Although hunger and severe malnutrition persist, today the prospect of widespread famine is receding. . . . [And] India's production of wheat [for example] has climbed 50 per cent between 1865 and 1969. . . .
>
> (Lester R. Brown, *Seeds of Change; The Green Revolution and Development in the 1970's*, N.Y., Praeger, 1970, pp. 4-5.)

Nick Eberstadt, of the Center for Population Studies at Harvard, argues that figures about hunger and malnutrition are inflated by the news media and by experts. In addition, he states that food production could easily be increased to feed a growing population.

[While many experts say as many as one billion people are malnourished, Eberstadt uses a figure produced by the World Health Organization that ten million children under 5 are severely malnourished.]. . . This would imply, in view of the rate of children to adults in the poor world, a total population of about 70 million chronically malnourished people. . . . For 70 million people to be threatened with death through starvation in a world as rich as ours is so shocking and outrageous that it may tend to obscure the fact that this is less than two percent of the world's population -- a lower proportion, in all likelihood than ever before.

It is, moreover, a proportion which is small enough to be eliminated altogether. . . . In agriculture, raising worker productivity means increasing crop yields per acre. Few people realize the potential which lies here. We think Bangladesh a basket case because it uses every inch of its land, sends 85 percent of its work force into the fields, and still seems to grow too little food to get by. But how many of us know that rice yields per hectare in Bangladesh are only 53 percent as great as the world average, 24 percent as great as America's, and only 15 percent as great as can be achieved on experimental stations *in Bangladesh*. Were Bangladesh merely to raise its rice yields to the world average, its per capita production would be over 530 pounds, higher than Japan's at the beginning of the 1960s. There is no technical reason why this could not be done. . . .

(Nick Eberstadt, "Myths of the Food
Crisis," *New York Review of Books*,
February 19, 1976, p. 32f.)

UNIT II: ARE THERE LIMITS TO GROWTH?

FOR TEACHERS

INTRODUCTION

The activities in this unit explore the perplexing and complicated questions of the limits to growth as related to land use, energy needs, the oceans, and peoples' relationships to one another in a changing environment. There are no easy answers. Different interests lobby for different positions in state and national capitals around the world. And often, whether the issue be energy conservation, Law of the Seas, or development of the Amazon basin, individuals who support limits to growth in their local communities are proponents of expansion in the national or international arena, and vice versa.

In the opinion of many environmental experts, we are near the limits of the amount of population growth, industrialization, pollution, food production, and resource depletion that the earth can sustain. Some, such as the Club of Rome, concluded after exhaustive study that these growth limits will be reached within the next 100 years. Others sharply disagree. The developing countries are especially sensitive to the "limits to growth" thesis. Their development requires an increase, for example, in food and industrial production. Decisions must be made today and during the balance of the 20th century that will determine both the quality of our physical environment as well as of our social environment. The quality of life for all passengers on Spaceship Earth will depend on our ability to make careful and conscientious decisions about growth, in both our natural and built environments. This unit is designed to help students develop an appreciation for the concept of environmental interdependence and growth in an expanding world.

UNIT OUTLINE

Lesson 1: Forecasting Growth

Subject Areas

- Social Studies
  - Current Events
  - Sociology
  - Area or World Studies
- Mathematics

Lesson 2: Limits to Growth -- A Role-Playing Activity

Subject Areas

- Social Studies
  - Current Events
  - Area or World Studies
  - Civics/Problems of Democracy
  - Modern History
  - Economics

Lesson 3: Energy and the Environment

Subject Areas

Social Studies	Science
Current Events	
Modern History	

Lesson 4: The New Frontier in Brazil: People, Progress, and the Environment

Subject Areas

Social Studies	Science
Area or Culture Studies	
Economics	
Current Events	
American History (optional)	

Lesson 5: The Oceans

Subject Areas

Social Studies	Science
Current Events	Biology
Modern History	
Economics	
Political Science	

STRATEGIES AND OBJECTIVES

LESSON 1: FORECASTING GROWTH*

The purpose here is to teach the concepts of exponential* growth and doubling time. Specifically, students will learn how to recognize the difference between exponential growth and linear growth and how to estimate doubling time. These are important skills and understandings if one is to comprehend fully the current debate about growth. Fortunately, the ideas are not difficult to master.

The data used in this lesson have to do with city growth. Two cities, Sao Paulo, Brazil and New York City, are compared. Students attempt to forecast the size of these cities in 1980 using population figures for 1950, 1960, and 1970 as a basis for the projections. "Forecasting," incidentally, connotes the kind of precision associated with the weather bureau. Often correct, but be prepared for surprises. "Prediction" connotes an exactitude that will certainly elude us—and the professional soothsayers as well.

Procedure

1. Make copies of the graph on page 34 for the students and an overhead transparency for yourself. Students will need to have a straightedge of some kind for drawing lines on the graph.

2. Tell the students that the small circles on the 1950, 1960, and 1970 lines represent population figures for Devonton, a fictitious city. In 1950 Devonton had a population of one million, in 1960 two million, in 1970 three million.

3. Ask the students to draw a line through the three points and to continue the line until it intersects the 2000 line. Assuming that Devonton continues to grow as it did from 1950 to 1970 what will the population be in 1980? In 2000? How much population did Devonton add between 1950 and 1960? Between 1960 and 1970? How much do you think it will add between 1970 and 1980?

This is an example of *linear* growth. Devonton is adding the same number of people in each time period—one million people every ten years.

4. Now ask this: Starting in 1950 how long did it take the population of Devonton to double? How long did the next doubling require? And the next? (Answer: First doubling, 10 years, second doubling, 20 years, third doubling, 40 years.) We'll come back to this.

5. Now explain to the students that you are going to ask them to do some forecasting of growth using real data for two urbanized areas—Sao Paulo in Brazil and New York. Give them the 1950 and 1960 data and ask them to mark their graphs accordingly, by placing dots or x's.

Urbanized Area	In Millions	
	1950	1960
Sao Paulo	2.4	4.5
New York	12.3	14.1

6. Assuming linear growth, what populations might be expected for Sao Paulo and New York in 1970? (Note that Sao Paulo added 2.1 million to its population between 1950 and 1960. If it again added 2.1 million between 1960 and 1970 the population would be 6.6 million in 1970.)

How many people did New York add between 1950 and 1960? If you add that same amount to the 1960 figures (remember, adding the same amount is what gives you linear growth), then what would you expect for 1970?

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* Strictly speaking, we are not dealing here with exponents. The process rather, is exactly the same as compound interest, where a constant percentage is applied to a base, added to that base, and the percentage again applied to the increased base. As the base becomes larger, so do the increments. This is now the popular usage of the term "exponential growth" and we use it here in that way.

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* From *Explorations in the Emergent Present* by Robert Hanvey. INTERCOM #77. Center for Global Perspectives, Winter 1974/5. Reprinted with permission.

7. Now provide the figures for 1970 and ask the students to place them on the graphs as dots or whatever. 1970: Sao Paulo, 8.4; New York, 16.1. The population figures for each city are now indicated on the graph as three dots. Students should connect the dots for each city by straight lines from point to point. For Sao Paulo, perhaps the students can manage a curve that connects the points.

8. Now to the forecast for 1980. Ask the students to project the lines for the two cities until they intersect the 1980 line. What populations are forecast? Which city will be larger in terms of population?

Projecting the Sao Paulo line or curve may be difficult. Here is a way of arriving at an estimate. Figure how much growth occurred during the 10 years between 1950 and 1960:

4.5/2.4 = 1.88 (Sao Paulo grew by 88%)

. . . and how much growth between 1960 and 1970. . .

8.4/4.5 = 1.87 (about the same as the previous decade)

Students can project the 1980 figures using the same rate of growth, say 1.87. That means multiplying 8.4 million (the 1970 population) by 1.87, or 15,708 million for 1980.

9. The students can place that dot (the 1980 figure for Sao Paulo) on their graphs and connect with the dot for 1970.

Ask this: If Sao Paulo continued to grow at the same rate until 2000, what would its population be? Using for each 10 year period the 1.87 rate (which is a bit higher than the actual rate because these figures have been rounded off): 1980, 29 million; 2000, 55 million.

10. Ask the students: Is Sao Paulo's growth linear, adding the same amount of population each decade? Clearly not! Instead, the population of Sao Paulo is growing *exponentially*. Point out that the shape of exponential growth is a rising curve, not a straight line.

11. Now let's come back to doubling time. This is very different in exponential growth as compared to linear growth. Ask students to use their graphs and estimate how many years were required for the Sao Paulo population to double, starting in 1950, and then how many years for it to double again. They should estimate between 11 and 12 years for each doubling. Note that the doubling time stays the same, 11 years for each doubling, rather than extending over longer and longer periods as with linear growth. Suddenly, and surprisingly, you have huge numbers to cope with.

If you know the doubling time, you can quickly estimate the annual rate of growth. And if you know the annual rate of growth, you can estimate the doubling time. There is an easy way to do this, providing the rate of increase is less than 15 percent. (For figures above 15 percent it is increasingly inaccurate.) A figure growing at the rate of 1 percent will double after 70 increments. A figure growing at 2 percent will double after 35 increments. You might test this on the calculator. The number 70 is the key part of our estimating procedure.

If we divide 70 by the doubling time, we get the annual rate of increase. Thus, 70 ÷ 11 = 6.36 (%).

And if we divide 70 by the annual rate of growth, we get doubling time. Thus, 70 ÷ 6.36 = 11 (years).

12. Ask students to compute the following. The present rate of population growth in the world is 2.1 percent. How many years would be required for the world population to double if that rate of growth continues? 70 ÷ 2.1 = ? (The correct answer would be a bit over 33 years.)

To simplify the making of the graph the exact figures for Sao Paulo and New York were not given. They are as below:*

Urbanized Area	In Thousands		
	1950	1960	1970
Sao Paulo	2,449	4,537	8,405
New York	12,331	14,114	16,077

The actual rate of growth for Sao Paulo seems to be 6.36 percent annually in the period from 1950 to 1960 and in the period from 1960 to 1970. This can be checked by arithmetic or with a calculator, by using 1.0636 as a constant and applying it first to the 1950 population of Sao Paulo, and then reapplying it to the new product for a total of ten times.

1.0636 × 2.449 = 2,605 (rounding off)

1.0636 × 2,605 = 2,771, etc.

The tenth, or 1960 figure, should be about 4,537.

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* Figures from Kingsley Davis, **World Urbanization, 1950-1970: Basic Data for Cities, Countries, and Regions, Volume 1**, University of California, Institute of International Studies.

LESSON 2: LIMITS TO GROWTH -- A ROLE-PLAYING ACTIVITY*

In Lesson # 1 students compared the growth of two cities and saw that one of them was growing exponentially. But the implications of that growth were not explored. What happens with exponential growth? Can it go on and on? Or are there barriers?

In this lesson students consider two instances of exponential population growth, one at the local community level and one at the world level, as a way of illuminating some of the problems posed by growth and the limits that may curtail it. The lesson also introduces the possibility of conscious control of growth.

The first segment of the lesson calls for a brief simulation of a city council meeting in an American community faced with explosive population growth. Students play the parts of: city council members; a developer wanting permission to build 1000 new homes on a 500 acre tract of land he owns on the outskirts of the city; the water and sewage commissioner; a civil rights spokesman; and an environmental action group spokesman. Although the role-playing activity can be handled very rapidly it will require two class sessions to introduce, play, and debrief.

The second segment of the lesson looks at the limit to growth posed by a finite amount of arable land in the world. At what point will the world's population come up against the limits of land that can be cultivated to produce food? Are the choices to be made similar in any way to those facing the local community?

Procedure, Part I

1. Explain that this session will be devoted to a simulation of a city council meeting in a city that is growing very rapidly and facing some of the problems of growth. There are seven roles: three city council members and four individuals who wish to present their views to the council.

2. Ask for volunteers or assign the roles. Each individual should receive only his own role card except for the city council president who should also receive the role descriptions for the other two council members. (Duplicate the role descriptions on pages 35-36)The water commissioner should be mathematically competent and may need an assistant, since he must perform calculations *and* make a graph in preparation for his presentation.

3. Those not receiving roles will be considered members of the audience at the council meeting, and should feel free to offer opinions and proposals *after* all the presentations have been made.

4. Those who do have roles should study them for at least five minutes. In playing the parts, they should *not* read them but should instead try to act in a way that is true to them and that represents the information supplied in the role description. They should be as persuasive as possible.

5. The procedure followed by the council needs not be strict. The council president can open the meeting, briefly list the four people who will be giving presentations, and get underway. "We will hear first from G. Zwinger. . . ."

6. After each presentation members of the council can ask questions but there should be a time limit. Most of the questioning and discussion should take place after the completion of all presentations. The audience can participate at that time.

7. Near the end of the period the council should vote on the resolution offered by Urthmom.

8. You might wish to tell students at the end of the period that the simulation is based very roughly on a real case—that of the city of Petaluma in California. The population growth of Petaluma provided the model for the population figures of Bursting. In Petaluma there was a water supply problem and a sewage handling problem. In June 1973 the citizens of Petaluma approved an ordinance that rationed growth to 500 new homes per year. But a United States District Court ruled that such rationing is invalid. The city is appealing the decision.

Procedure, Part II

1. Review yesterday's simulation and in particular its conclusions. If the council voted *for* the resolution, what were the most important considerations in deciding to limit growth? If the council voted *against* the resolution what solutions to the problems of growth, e.g. water supply, were offered?

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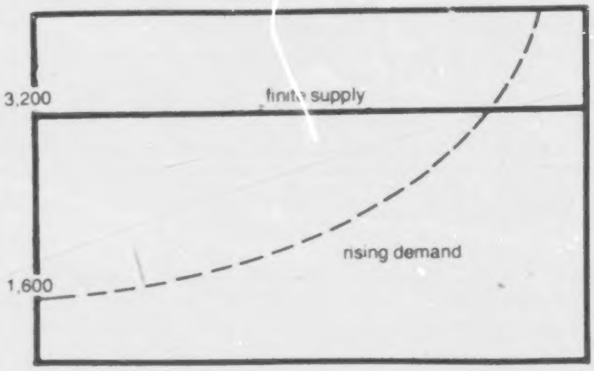
* Robert Hanvey, op.cit.

2. Sketch the graph below on the board or on a transparency. Omit the numbers at this time.



3. Referring to the graph, what resource was in "finite supply" in the city of Bursting? Why was there "rising demand"?

4. In the conclusions reached yesterday, which of the following applied to the water supply problem?

- There was a belief that the "finite supply" was not really finite, that it could be increased.
- It was assumed that the "finite supply" really was finite and that steps would have to be taken to limit demand by controlling growth.

5. Now explain that this graph, which describes the water supply problems of a single city, may be used to describe other kinds of supply problems that face the whole world. One of these problems is that there is only so much land in the world that can be cultivated to grow food. To be specific there are 3,200 million hectares of arable land. That's the "finite supply" on the graph.

How much of that "finite supply" do we need at the present time? According to one estimate every human being needs (on the average) four-tenths of a hectare to produce the food he or she consumes. And there are 4,000 million human beings. So, we need 1,600 million hectares.

6. Now add the figures shown on the graph above.

7. So, at the moment we are using only half the "finite supply" of arable land. But world population is growing at the rate of 2.1% percent annually and will eventually double. When it doubles to eight billion people, they will require 3,200 million hectares, or all of the arable land. Question: How long will it take the world population to double? Will we then be in big trouble?

8. Now let's come back to some of the questions raised in the city of Bursting.

First of all, *can we increase supply?* Suppose the productivity of the land could be increased by a factor of four. In that case we would need only one-tenth of a hectare to feed each person. How many people could then be fed if we used all arable land? Well, ten people could be fed for each hectare and there are 3,200 million hectares, so we could feed 32 billion people.

There are specialists who believe this kind of an increase in productivity is possible. Extensive use of new types of seeds and heavy application of fertilizers and pesticides will certainly make some increases possible. But then we will have a pollution problem. In the Philippines heavy application of chemicals to aid the growing of new strains of "miracle rice" resulted in the death of fish in local ponds and thus in a net loss of protein in the diet.

9. Can we do something about food supply that doesn't depend on arable land? Herman Kahn suggests hydroponics. Are there other possibilities? Some students might research this.

10. The other question raised by the Bursting case is: Can we control growth? Just as in the city of Bursting there are those who want to control growth and those who don't.

- Many of the developing countries feel that they need population growth and view the family-planning efforts of their richer neighbors with suspicion.
- Many of the developing countries believe that their first need is economic development, that population control will follow naturally as soon as people feel economically secure.
- Some specialists (see the earlier sections on Mesarovic and Meadows) believe that population control must start now or exponential growth will bring disaster to at least some parts of the globe.

11. Ask the students: Suppose, just like the city council of Bursting, you were planning policies to cope with the problem of "finite supply" and "rising demand," but in connection with world food supplies rather than local water supplies. And suppose you had $100 million to spend on research that might help solve the problem. How much of the $100 million would you allocate to each of the following:

- research in increasing the productivity of land
- research in slowing down population growth

W. Urthmom, Environmental Activist

Your view is that many of the problems that we have had with the environment can be traced to uncontrolled growth. We also have had the notion that people have an almost unlimited right to do what they want with the land they own. But our traditional beliefs in unlimited growth and development have to give way to higher rights—the right of the public to a humane environment. One of the most important aspects of a humane environment is lack of crowding and some untouched land. Show a real estate developer 10 acres of natural land and he sees 40 houses on it. Our aim must be to keep at least some of our landscape in a natural state. The profit motive must not always win. You wish the city council to consider an ordinance that would stop further building until there were approved plans to save some of the open spaces around the city. So you have proposed the following resolution:

> Resolved, that no further building permits be issued for the next two years or until a plan has been worked out for carefully controlled growth that will not threaten the natural landscape or our capacity to provide public services—water, sewage disposal, schools, etc.

O. Penn, City Council Member

You own a local hardware store and know that new houses and an increasing population are good for business. Your favorite saying is "A town that stops growing starts dying." Back in 1955 the business people of Bursting weren't very prosperous. But now there are big new stores and shopping centers that stay open every evening and business is booming. So what if it's a bit crowded. The sound of those cash registers is music to your ears. And everyone shares in the prosperity.

You are enough of an optimist to believe that somehow or other the water supply problem can be solved. Instead of stopping the building of new homes the council should appropriate some money to bring in some specialists who could work out ways to increase the water supply.

C. Nile, City Council Member

You have lived in the city of Bursting for thirty years. When you first moved here it was a small, sleepy town that came alive only on Saturdays when local farmers came in to shop. And you liked it that way. It was a quiet, peaceful place. But the population has been growing since 1955, and it is no longer a quiet, peaceful place. The meadows are covered with houses, the streets jammed with cars, and the schools are on double session because of lack of space. Bursting has become just another uncomfortable city. Maybe it doesn't matter if someone builds another 1,000 houses. The place that you loved has already disappeared. On the other hand, perhaps if growth can be stopped some of the good qualities can be brought back to life. It might be worth a try. But then again. . . .

M. Fehrminder, City Council President

There are two items of business at this meeting. One is the request of a real estate developer for permits to begin house building on a tract of land at the outskirts of the city. The other is a proposed ordinance that would block further building until a comprehensive plan for controlled growth had been worked out. Several people have asked to speak at the meeting and you have decided on the following order:

G. Zinger	real estate developer	W. Urthmom	environmental activist
T. Piper	water & sewage commissioner	O. Reiton	civil rights leader

The speakers have five minutes each, and you may invite additional comments from the audience, if you wish. Other members of the city council will also have contributions to make. After hearing all those who wish to speak, you will take a vote in the council on the following:

> Resolved, that no further building permits be issued for the next two years or until a plan has been worked out for carefully controlled growth that will not threaten the natural landscape or our capacity to provide public services—water, sewage disposal, schools, etc.

T. Piper, Water and Sewage Commissioner

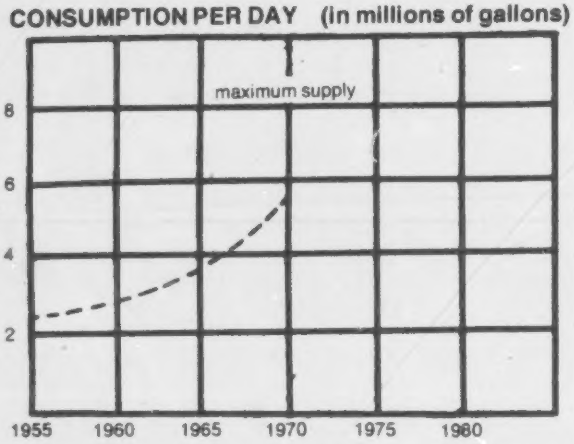
The city of Bursting has a water supply problem. The facts are that the consumption of water is 200 gallons per day per person while the maximum supply of water is eight million gallons per day.

Thus, the maximum number of people who can be supplied with water is 40,000 (8,000,000 ÷ 200 = 40,000). The population of Bursting has been growing as follows:

1955	11,000	1970	26,360
1960	14,720	1975	(your estimate)
1965	19,700	1980	(your estimate)

(To help you compute these, see note at end of Piper's part.)

On the basis of your computations you believe that the population of Bursting will reach the limits of the water supply in the year ____.



After you have worked out your estimates you should prepare a simple graph on the board or a large piece of paper. You can use this during your report to the city council. The graph might look like the following (but add the figures for 1975 and 1980).

You may be asked during the city council meeting whether there are any ways to increase the water supply. Your answer should be that this part of the state suffers water supply difficulties and you do not believe that supplies can be increased. In the long run, perhaps 20 years away, there is the possibility of recycling water so a community uses the same water over and over. But that's just a possibility and it won't help us now.

Note:

Compute your population estimates by determining the percentage of growth in previous five–year or ten–year periods, then project the same growth forward. For example, the growth between 1965 and 1970:

26,360 ÷ 19,700 = ___ , then multiply the 1970 figure by this figure to get a projection for 1975.

G. Zinger, Real Estate Developer

Ten years ago you purchased 500 acres of land on the outskirts of the small city of Bursting. Your honest intention, as a good businessman, was eventually to build houses on the land and make a profit. There is now a strong demand for new housing in small cities like Bursting, as people move away from larger cities. You want to begin building. The new houses will be modern and attractive and reasonably priced. They will enable many American families to realize the American dream—a house of one's own in a pleasant community. Building the homes will provide jobs for many local workers for several years. The new homeowners will pay taxes averaging $500 a year to the city and will shop at the local businesses, thus helping the local economy. Assuming an average family size of four members, the 1,000 new homes will add 4,000 people to the population of Bursting but it will take at least five years before all the homes are built and occupied. You are respectfully requesting the necessary permits so that you may begin building. If you cannot build, you will suffer a considerable financial loss because the land is not suitable for agriculture.

O. Reiton, Civil Rights Leader

You object strongly to the possibility that an ordinance might pass that limits the building of new homes. You are concerned about the basic American right to live where you want to live. According to a study by the federal government over 200 communities have already passed ordinances or imposed delays that affect new building. It isn't right for an American community to build a wall around itself and deny entrance to newcomers. It is part of our tradition to encourage and allow the free movement of people. One thing that especially concerns you is the tactic used in some communities of a special tax or surcharge on water and sewer hookups for new homes. This raises the price of the homes and makes them too expensive for low and middle income families. It's a kind of wall with openings in it for a selected few. That's downright un–American!

Explorations

Students may follow up this activity with another which looks into the implications of continuing technological growth - in this case the environmental, economic, and diplomatic issues surrounding commercial flights of SSTs into the United States.

LESSON 3: ENERGY AND THE ENVIRONMENT

The purposes of this lesson are (1) to acquaint students with patterns of energy supply and consumption, (2) to help them understand the debate over alternative sources of energy and their impact on the environment, and (3) to have them consider their own role in the conservation of energy. In the first section, the students will work with charts and tables concerning energy as a basis for computation and interpretation.

GOALS

1. To develop increased awareness of the relationship between seemingly local concerns and global networks.
2. To recognize that a healthier environment depends on people making difficult choices, based on careful measurement of the consequences of such choices.
3. To use a wide variety of activities to explore the natural and built environment.

LEARNING OBJECTIVES

Students will

Knowledge

1. learn about the global patterns of energy production and use;
2. understand the interdependence of nations, as illustrated by energy;
3. understand the meaning of energy dependence, the options available, and their impact on the environment;
4. come to a personal understanding of the importance of energy conservation;

Skills

1. analyze data from graphs, tables, and charts;
2. do individual research and analysis of alternative energy sources and their environmental impact;

Awareness

1. develop an awareness of possible "limits to growth" in terms of energy supply;

2. develop a sensitivity to the potential threats to environmental integrity resulting from development of alternative energy sources.

ANSWERS AND POSSIBLE ANSWERS

1.

North America	Latin America
Asia, inc. Mid East	Oceania
USSR	Oceania
North America	Oceania
North America	Asia

2. North America with 49 percent; Latin America. The information is not sufficient because it gives no idea of the consumption levels within the regions.

3. Students will probably suggest that the regions with the smallest reserves are the most dependent, those with the largest the least dependent. Encourage them to consider the amount of energy used as another factor. While the U.S. has the greatest percentage of known energy reserves, it is dependent on the energy resources from other countries because it uses so much. (More on this in the next graph.)

4. Possibilities: Countries with high Gross National Products (GNP) use more energy per capita than countries with low GNPs. The richer a country, the more energy it uses. The more industrialized, the greater its energy consumption.

5. Students might discuss this in terms of how the use of energy affects lifestyles. For example, greater mobility, more conveniences, and more comfortable physical environments (air conditioning) all require extensive energy consumption. They should also consider the negative side of that lifestyle - traffic congestion, polluting exhausts, stagnant air, etc. Do students think the quality of life is substantially better in the United States than in Canada or in the northern European countries? Is there a limit beyond which increased energy usage will not benefit the quality of life?

6. World energy reserves would be rapidly depleted.

LESSON 4: THE NEW FRONTIER IN BRAZIL: PEOPLE, PROGRESS AND THE ENVIRONMENT

As needs for minerals and farm land mount, nations are turning to their few remaining, untapped regions.

In Brazil, for example, the vast Amazon wilderness has for centuries defied exploration and development efforts. Scattered tribes lived there, completely separate from white culture and values and white diseases. But during the past several years, the Amazon barrier has been broken by the construction of the Transamazonian highway, which became a source of controversy in Brazil comparable to what the Alaskan pipeline has been for us.

Much of the road network has already been built but there are still unsettled questions about the construction of the northern east-west road and the future development of the region. Proponents -- government officials, construction companies, and multinational corporations and agribusiness interested in developing the Amazon -- point to the importance of (1) facilitating economic growth through the exploitation of mineral and other natural resources in the region; (2) opening up new lands to relieve population pressures in densely populated areas; and (3) establishing a communications network throughout the country in order to guarantee the security of the region. Critics argue that this project will erode the soil, destroy vegetation, and threaten indigenous cultures. Some have even predicted that the razing of the jungle will have a long-term effect on climate patterns in other, distant, parts of the world.

This case study is designed to help students deal with the environmental questions which are part of the larger controversy. The study describes the situation in the Amazon and discusses some of the advantages and disadvantages of developing the region. Students are asked to evaluate the impact of a changing environment on a society and its culture, and to deal with the concept of "progress" as it is related to growth and to the preservation (or destruction) of the physical environment and indigenous cultures.

GOALS

1. To recognize that a healthier environment depends on people making difficult choices and carefully measuring the consequences of those choices.

2. To understand that culture determines the variety of ways humans adapt to and alter their surroundings.

LEARNING OBJECTIVES

Students will

Knowledge

1. learn about the people and the physical environment in the Amazon region of Brazil;
2. recognize the impact of a technological achievement, such as a road, on the social and physical environment;

Skills

1. develop reading and reasoning skills in evaluating the changes development has brought to northern Brazil;
2. use research and writing skills in discovering, recording, and analyzing parallel situations;

Awareness

1. develop an appreciation for the integrity of a culture;
2. consider their own value orientation regarding progress, growth, etc.

ANSWERS AND POSSIBLE ANSWERS

1. Students should review the reading and list some of the specific ways that the Indians' way of life has changed (diseases, land conflicts, technology, etc.).
2. As tribal groups are moved from one location to another, families may get separated and relationships may break down after contact with alien settlers. Traditional tribal bonds may also be broken as former leaders lose their status and tribes are dispersed.
3. Benefits could accrue from the exploitation and export of the mineral resources that are supposed to lie in the Amazon region. And increased food production there could help feed the hungry in other parts of the nation, while improved communications could help the Indians. Students should also weigh the negative side, the destruction of the tribes' way of life and of the natural environment.

4. Each student should be encouraged to come to his or her own answer on this question, after evaluating the data.

5. This question involves students in thinking about their own values. It is important for them to consider what "progress" means to them and how they weigh the demands for economic growth, development, etc., against concern for the preservation of human and physical environments.

LESSON 5: THE OCEANS

Two-thirds of our globe consists of water. And as the world's need for food, energy, and minerals outstrips dry lands' resources, nations have increasingly turned toward the oceans. Conflicts have been inevitable.

This lesson looks to the oceans and some of the issues related to their exploitation. In the first portion, students will look at data relating to commercial ocean fishing. They will see that certain nations dominate the fishing industry and that despite (and/or because of) more sophisticated fishing methods, fish catches have declined. In the second portion, students will role play representatives of nations participating in a Law of the Seas conference. Fishing disputes will be only one of several topics at this mock conference. Other issues - pollution, rights to minerals, and military transport - will also be raised and need resolution.

GOALS

1. To recognize the complex operations of interdependent relationships in the larger global setting.
2. To recognize that environmental issues involve deep conflicts of interest and viewpoint.
3. To recognize that population influences all other environmental issues.

LEARNING OBJECTIVES

Students will

Knowledge

1. learn that the oceans are a major source of food, especially protein;
2. understand the issues regarding use and control of fisheries and the impact of overfishing on fish resources;
3. study and evaluate proposals from the Law of the Sea conferences to control and conserve fisheries;

Skills

1. gain experience in interpreting data from charts, tables, and graphs;

2. develop organizational and speaking skills through participating in a debate related to fisheries;

Awareness

1. develop an appreciation for the interdependence of nations and the interrelatedness of systems - both human and ecological;

2. come to an understanding of the importance of conservation practices for the world's oceans.

ANSWERS AND POSSIBLE ANSWERS

1. After a period of rapid growth there has been a sudden sharp decline in fish catches.

2. The phrase "maximum sustainable yield" suggests that there is a limit on the quantity of fish that can be caught year after year. If remaining stocks are incapable of replenishing the previous year's supply, the amount available for future years' catches will fall.

3. Overfishing. The maximum sustainable yield has apparently been passed.

4. The price will go up. The poorer nations will have to cut back on their fish consumption as fish becomes too expensive for their people's budgets. The wealthier nations, of course, can afford the higher costs. It is thus likely that the amount of protein in poorer nations' diets will dwindle further.

5. All have access to the oceans from their coastlines.

6. Japan. Small land area, large population. No recourse but to turn to the sea for protein resources.

7. U.S.S.R., U.S., Japan, United Kingdom, France, Philippines, Italy. All, except the Philippines, are industrialized countries.

8. The developing nations are unable to pay as much as can the industrialized nations.

The Ocean Resources Game*

Teacher's Directions

Learning Objectives

Through playing roles of decision makers of various nations, students learn about issues and positions involved in exploiting the wealth of the sea, including minerals, oil, and fish.

The Situation

The Sea of Plenty is becoming badly polluted. Some scientists predict that living resources (fish, etc.) are diminishing and that there will be almost no edible fish and shellfish within 25 years if present trends continue. An international conference has been called by nations surrounding the Sea of Plenty to consider adopting agreements for resolving their conflicting claims to territorial limits, rights of passage, exploitation of the deep sea beyond continental shelves, etc.

Sequence

Preliminary preparation: The class should look at and discuss the data and diagrams already presented. Students should be familiar with the basic terms, such as continental shelf, seabed, manganese nodules, territorial limits, etc.

First Day

1. Distribute the map to the class.

2. Explain the situation facing the countries around the Sea of Plenty. Tell them that their objective, as representatives of these nations, is to work out fair agreements on the use of the ocean's resources. The basic issues they should consider are:

- How far should a nation's jurisdiction extend?
- Should there be a national economic zone beyond the territorial limit? If so, how far?
- Do nations have the right to pollute the oceans, whether off their own shores or on the high seas? If not, what should be done about it?
- Should the ocean be considered the common heritage of the people of the world? If so, should an international organization be formed to regulate the mining of the seas and use a percentage of the profits to foster the development of poorer nations?

There will be issues between particular countries and the broad issue, of importance to all, of what to do about resources and the deep seabed beyond national jurisdictions.

3. Assign the countries. Each student should receive all the country profiles. Reading the profiles and understanding the map may be assigned as homework before the game begins.

Second Day

1. Students first meet within their "nation" to consider their objectives and how they intend to pursue them in the coming international meeting (10–15 minutes).

2. The International Conference on the Sea assembles. One student acts as chairman, and the delegates determine their own rules for proceeding. Suggested procedure: Each nation speaks, one student from each nation acting as the spokesman for his country. This may be the Chief Decision Maker or another member of the delegation (remainder of the class period).

Third Day

1. The countries meet again to determine policies and stategies based upon what has happened at the previous day's international meeting.

2. Negotiating period: Countries may make bargains, agreements, or alliances with other countries for the second round of the international conference.

3. Countries meet individually to determine presentations for the next ICS meeting.

4. Second meeting of the ICS.

5. The cycle of national meetings, negotiations, and ICS meetings can continue until agreement or an impasse has been reached.

Debriefing Questions

1. What happened in the game? Were all nations able to reach their goals? If agreement was reached, was it in fact fair to all nations?

2. How did the game compare with reality? What changes should be made to make it more realistic? What additional parties or pressure groups might be involved? How would their presence alter the outcome?

3. Do students think the mileage limits should be uniform for all nations? Would that be fair?

4. What will be the consequences for the world if agreement is not reached?

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RESOURCES

Built Environment: A Teacher Introduction to Environmental Education. American Institute of Architects. 1975.

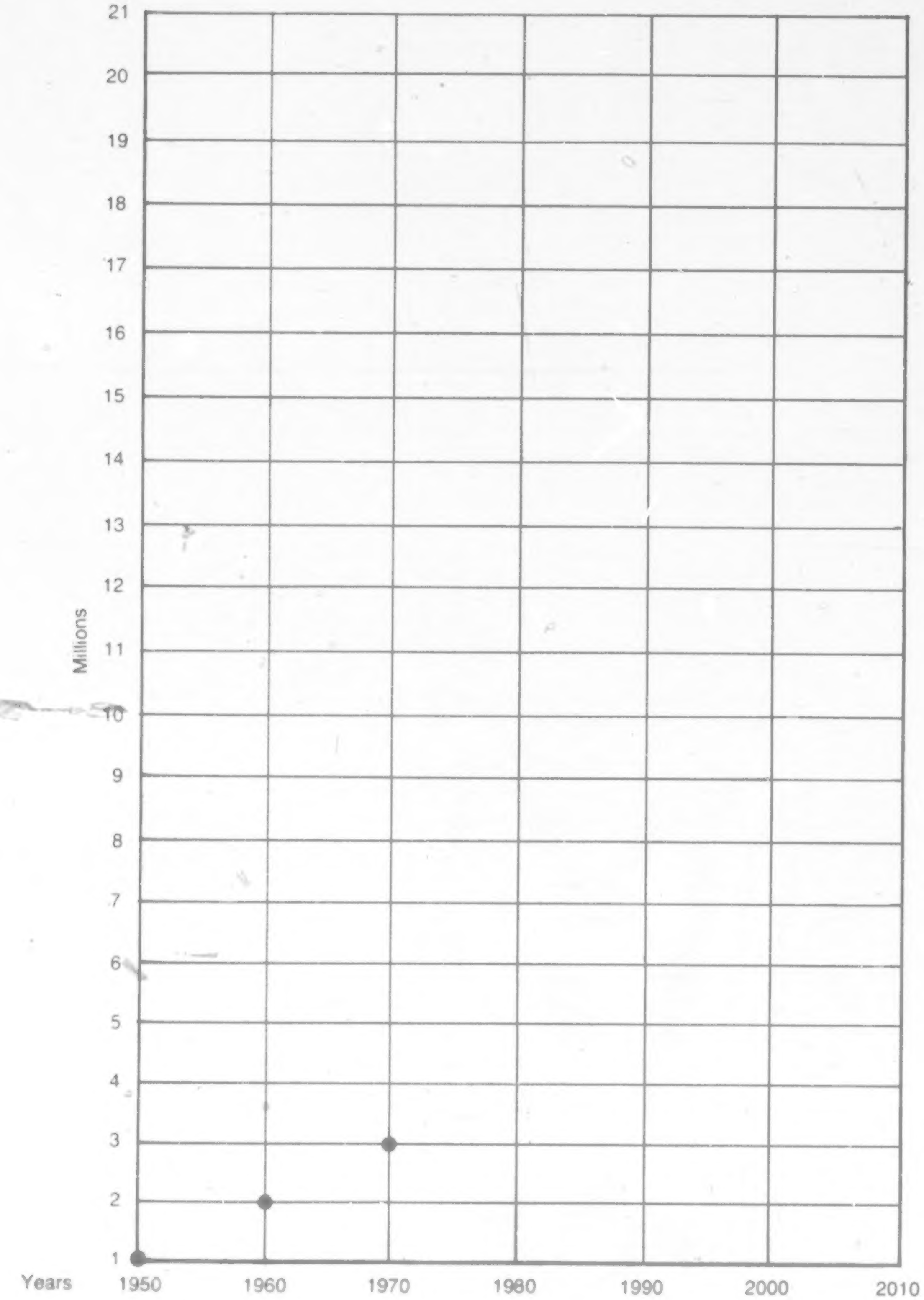
Proposed Humanities Framework for California Schools. Humanities Framework Committee. Sacramento, 1975.

You Are An Environment. Noel McInnis. Evanston, Ill.: The Center for Curriculum Design, 1972.

Teaching for Survival: A Handbook for Environmental Education. Mark Terry. Ballantine Books, 1971.

Man's Impact on the Global Environment. Colin Wilson, ed. MIT Press, 1970.

LESSON 1: FORECASTING GROWTH



LESSON 2: LIMITS TO GROWTH

EXPLORATIONS

In this activity you are to try to assess the facts and weigh some of the political and economic choices posed by the development of commercial supersonic jets. In an interdependent world, questions of environmental integrity and "limits to growth" in one area may be intimately tied to the concerns not only of another region but of another nation. In the case of the SST (supersonic transport), the environmental and safety concerns of local residents in the New York and Washington, D.C. areas had to be weighed against national and international concerns, both political and economic, involving two other countries, France and Britain. In this case, the limits to growth question revolves around the environmental impact of bigger, faster airplanes. Is there a "limit" to the amount of pollution that should be allowed for aircraft? Is the extra pollution generated by an SST worth flying people back and forth across the ocean in 3 hours and 50 minutes?

Using the brief statements below as starting points, role play a discussion that might have gone on between U.S. policymakers, environmentalists, local U.S. residents, and foreign diplomats prior to the announcement that the SST would be allowed to land in the United States for a trial period. Select your role from the following list. The statements are given only as starting points for your presentation. Do some additional research for the presentation.

--U.S. Secretary of Transportation--the person with the ultimate responsibility for the decision:

"The question of the SST is very complex. We must weigh both the advantages and disadvantages. Clearly, there are some important technological and diplomatic advantages in allowing limited landings of the SST; yet we must also be aware of environmental concerns; we should not always equate progress with doing something faster."

--U.S. Secretary of State--the person concerned with maintaining good relationships with the two foreign countries involved--France and England:

"Allowing the Concorde SST a trial period will prevent 'economic retaliation' by British and French against either our airlines or important sales of weapons systems.... It is important to give fair treatment to two of our nation's oldest allies."

--U.S. environmentalists--the persons (scientists, biologists, etc.) concerned with possible damaging environmental consequences:

Some say that "exhaust emission from vast fleets of SSTs would seriously thin the atmosphere's ozone layer. This would permit more solar radiation to reach the earth and might eventually cause an increase in nonfatal skin cancer."

"Pollution produced by the Concorde's engine exceeds the levels of most other commercial jets--up to ten times as much carbon monoxide.

--**New York and Washington, D.C. residents**--the persons who would most likely suffer from pollution and physical damage wrought by the SST:

"Concorde's low frequency noise emissions trigger structural vibrations three and one half times greater than those generated by most subsonic jetliners. It's take offs and landings are up to twice as loud as most commercial jets."

--**Representatives from the French and British governments** and from the aircraft industry:

"The Atlantic run (from Paris and London to Washington, D.C., and New York) is essential if the makers of the Concorde are to sell more than the nine planes already ordered and begin to recoup their $3 billion development costs."

--**Other roles** could include representatives from the U.S. aircraft industry interested in blocking competition, representatives of local governments, etc.:

"The Concorde is just a 'rich people's toy'--the fare from Europe to the United States is up to 20 percent *more* than current first class fares for the same trip making the price over $1100."

"(The SST) produces more noise and pollution than the current generation of jumbo jets, gobbles fuel at a monstrous rate, and carries only 100 passengers in a cabin that is cramped and crowded by comparison with most large commercial jetliners."*

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* Positions quoted in *Newsweek*, February 16, 1976, pp. 17 and 19.

LESSON 3: ENERGY AND THE ENVIRONMENT

"The energy crisis could turn out to be one of the best things that ever happened" suggested one expert on energy and the environment. Why? Because "the crisis may lead more people to realize that the earth is not a throwaway commodity and that they must learn a new style of life that emphasizes recycling and the prudent use of resources."*

The "energy crisis" that began in 1973 raised some new conflicts. Many of those seeking to preserve the environment, had taken action to stall exploitation and exploration for certain energy sources. Although they had warned for years that the United States could not continue to consume energy at such a high rate, they were initially blamed for the crisis by those who wanted to increase production of energy. The latter argued that the United States should abandon "all this environmental nonsense" and make an all-out effort to find new domestic sources of energy.

In 1974, the government initiated Project Independence designed to achieve energy independence for the United States by 1985. Yet after two years of study, many experts have concluded that the costs of total energy independence, both financial and environmental, are too great and that the United States must learn to live with a measure of dependence on others in an interdependent world.

Hence, for environmentalists and energy producers alike, conservation of resources becomes very important. In the following activities you will learn something about who uses how much energy, how energy demand is continuing to grow, what alternative sources of energy are available, their impact on the environment, and how energy is used and might be conserved in your local community.

THE GLOBAL PICTURE

Before evaluating the impact of increased energy use and exploration in the United States, we might look at global energy sources and uses. The table, graph and questions on the next pages will start you on your way.

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* "The Long Term Value of the Energy Crisis," by Russel E. Train, *The Futurist*, February 1974, p.14.

Known Nonrenewable Energy Reserves by Region and Types of Energy, in Percentages

	FOSSIL FUELS					NUCLEAR POWER	TOTAL
	Coal	Crude Oil	Natural Gas	Oil Shale and Tar Sands	Total	Uranium	
Africa	2.5	14.0	11.0	0.8	3.9	25.4	4.4
Asia[a]	18.0	59.0	23.6	8.4	20.2	0.4	19.7
Europe	17.9	1.5	8.4	1.1	9.6	5.9	9.5
U.S.S.R.	23.0	8.9	31.6	1.3	14.4	n.a.[b]	14.0
North America	35.1	8.0	20.8	88.0[c]	48.9	54.1	49.0
Latin America	0.3	8.3	3.3	0.2	1.5	1.5	1.5
Oceania	3.2	0.3	1.4	0.1	1.7	12.7	1.9
Source as Percentage of Total Energy Reserves	46.4	12.0	5.9	33.2	97.5	2.5	100.0

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[a] This includes the Middle East.

[b] Unknown.

[c] According to the U.S. Bureau of Mines, North American oil shale and tar sands reserves may be severely overstated, since development of most of these reserves is not economic at the present time.

Source: Based on U.S. Department of the Interior, *Energy Perspectives: A Presentation of Major Energy and Energy Related Data*, February 1975, p.2.

NOTE: Known Nonrenewable Energy Reserves refer to the amount of energy remaining in the ground which geological and engineering studies indicate is recoverable in the future under existing economic and operating conditions.

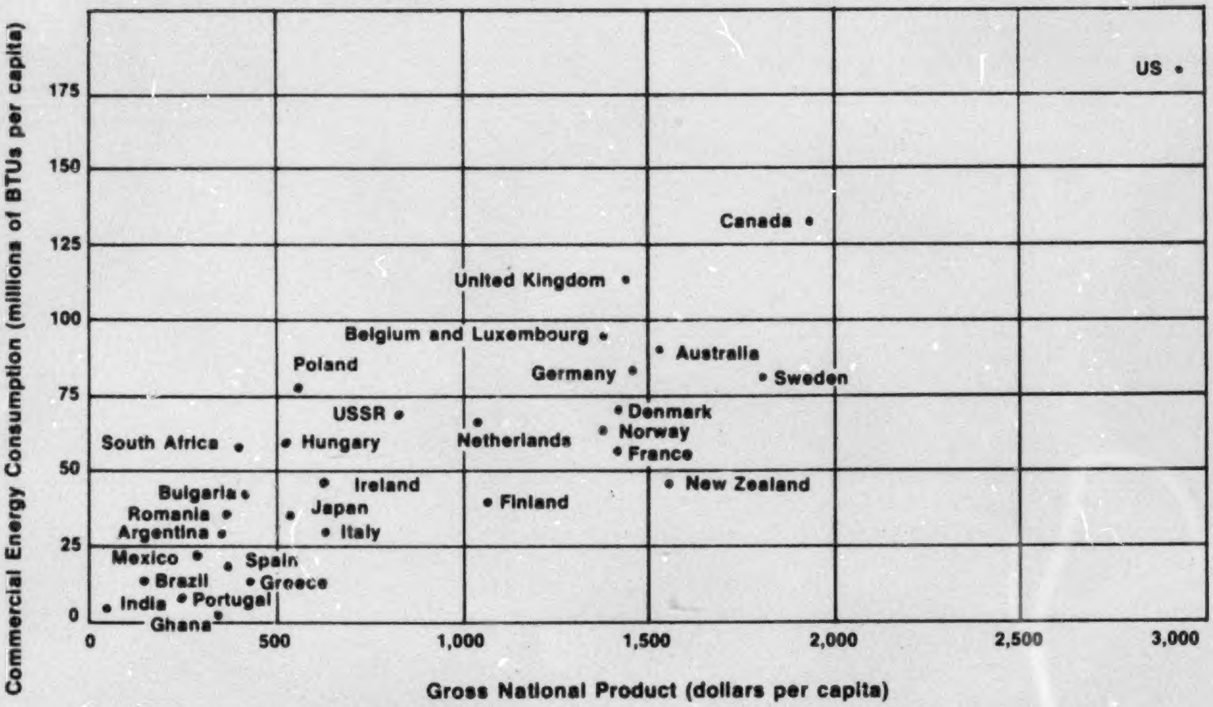
1. Which regions of the world have the largest/smallest known nonrenewable reserves of:

	Largest reserves	Smallest reserves
Coal		
Crude Oil		
Natural Gas		
Oil Shale and Tar Sands		
Uranium		

2. Which region of the world has the largest reserves of all types of energy? ____________________ What percentage of the total does it have? ____________ Which has the smallest reserves? ____________________. Is this information enough to tell whether a region is self-sufficient in energy? Why or why not?

3. Which regions appear to be most dependent on others for their energy supplies? Which least dependent? Does this situation encourage independent or interdependent energy policies?

Per Capita Consumption of Energy and GNP



1972 figures show a similar distribution of countries' per capita consumption and GNP. It would be interesting to see if the pattern has changed since the jump in oil prices.

Adapted from: Earl Cook, *The Flow of Energy in an Industrial Society*, *SCIENTIFIC AMERICAN*, September 1971, p. 142.

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4. How does per capita energy consumption vary among different countries? What generalizations can you make?

5. Is the quality of life related to levels of energy consumption? How?

6. What would happen if all nations consumed energy at the level of the United States?

THE NATIONAL PICTURE

The United States is the world's largest user of oil, natural gas, coal, and nuclear energy, requiring approximately 31 percent of all the energy consumed in the world. The 3 billion people in developing countries use only about 15 percent of the world's energy.

The United States currently imports approximately 16 percent of all the energy it consumes, including 44 percent of its oil needs. (This is in contrast to Europe which imports 90 percent of the oil it uses.) These percentages will increase in the coming years unless the United States can find new domestic sources or reduce its daily consumption of energy. Both alternatives have important consequences for the environment and are the reason for much public debate.

Our vast reserves of coal and the enormous power of nuclear energy offer great potential, accompanied by awesome dangers. The following readings will give you some idea of the issues and the alternatives.

The Energy Debate*

Early in 1976, three nuclear engineers quit their jobs with the General Electric Company. A few days later, another resigned a post with the Nuclear Regulatory Commission. For all four, the motive was the same: They believed that further development of nuclear power plants should be halted until proper safety systems could be developed. They feared that the chances of a nuclear accident were greater than stated by government officials and nuclear energy experts.

At about the same time, a group of electric companies announced that they were cancelling plans to build a huge coal-fired power project at Kaiparowits, in southern Utah. The reason: environmental protection groups had fought the project in the courts, delaying it for nearly a decade and adding enormously to the cost. The plant would have been large enough to supply the energy needs of a community of three million people. But power company officials, discouraged by the long delays, decided to give it up.

The two events are related. They are pieces in a confusing puzzle, one which frequently leads to bitter disputes among different groups within our society. There is no American consensus on what to do about energy. Every power source available to us presents serious problems, either economic or environmental—and yet the demand for energy keeps growing. The entire planet faces much the same dilemma.

Over the past few years, we've switched directions a number of times. Between 1968 and 1973, we became increasingly concerned over environmental factors. A drilling rig oil spill fouled the picturesque beaches of Santa Barbara, California and caused serious damage to marine life and water fowl. Angered citizens demanded a ban on offshore oil drilling and Congress and the President put the ban into law.

The proposed Alaska Pipeline was also delayed, because concerned citizens were afraid of the potential damage of hot oil spilling onto the delicate tundra ecosystem. Other measures also reflected a growing interest in environmental protection. For instance, strict limits were placed on the strip-mining of coal and companies were paying up to $5,000 per acre to restore the landscape of mined areas.

Then, in 1973, came the Arab oil embargo. In the weeks that followed, the Oil Producing and Exporting Countries (OPEC) quadrupled the price of oil. Suddenly Americans found themselves facing a crisis few had

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*From David C. King and Cathryn J. Long. *Shaping the Environment.* INTERCOM #83. Center for Global Perspectives, September 1976. Reprinted with permission.

ever expected—a shortage of fuel and a sharp increase in price. Waiting in lines for a few gallons of gasoline helped shift many people's attitudes.

Environmental concerns seemed less important and the availability of energy now became the major priority. The ban on offshore oil drilling was lifted, and the Alaska Pipeline was given a green light. Restrictions on coal mining were eased and so were the anti-pollution pressures on industry and automobile manufacturers.

In mid-1976, we find ourselves in a period of uncertainty. We now import more oil than ever before. What will happen if oil-producing countries once again use oil as an economic weapon by refusing to sell? Should we build more nuclear-power plants, despite the warnings of some? Or should we use more coal in electric generating plants? Coal is one of our most abundant resources; it's estimated that our known coal deposits could supply our energy needs for some 300 years.

But coal pollutes. One of the major reasons for the decline in the coal industry—a decline which led to grinding poverty in Appalachia—was the low cost of oil and the fact that it burned cleaner. Coal mining also involves land pollution. Some of our richest deposits lie close to the surface in a stretch of land from New Mexico and Arizona north to the Canadian border. Huge machines, as tall as 20-story buildings, scrape off the top soil and then chew up huge loads of the mineral. So, despite its abundance, coal presents serious questions about how we use our land—and what happens to our air. And while we will be able to produce synthetic gas and oil from coal, that technology is still being perfected.

—What are our alternatives? What combination of energy sources would present the best balance between satisfying our needs and preserving our environment?

—In exploring ways these issues affect your area, here are some statements on opposing side of the conflicts.

Nuclear Energy

A Nobel prize winner for physics:

I believe that nuclear fission is the only major nonfossil power source the U.S. can rely on for the rest of this century and for some time afterward.

Taking into account all types of reactor accidents, the average risk for the entire U.S. population is only two fatalities per year from latent cancer and one genetic change per year. Compared with other accident risks that our society accepts, the risk from nuclear reactors is very small.[10]

John Goffman, former professor of medical physics, University of California:

For the U.S.A. alone, it is estimated that 116,000 persons have been committed to plutonium-induced lung cancer from post-nuclear fallout. The plutonium from more nuclear plants would increase the risk.

Time Magazine, "The Great Nuclear Debate,", December 8, 1975:

The Atomic Industry—and a vast majority of nuclear scientists—believes that so drastic a step (stopping further nuclear power plant construction) would be utterly unwarranted; there has simply never been a disastrous accident in U.S. commercial power plants. That is not by chance. Each "nuke," as the power stations are called, must be designed to withstand the worst earthquakes, floods, or other "acts of God" ever recorded in its area. Every piece of equipment is supposed to meet the stiffest quality controls anywhere in civilized industry. If any components fail, layer after layer of "redundant" safety features are ready to be activated.

A journalist for *Science* magazine:

Like the aircraft industry, nuclear power is an evolving technology; new designs raise new problems or reveal seriously unsuspected flaws in older plants. Until last year, for instance, hardly anyone would have guessed that a workman with a candle could start an electrical fire that would knock out two of the nation's largest reactors and narrowly miss causing a disastrous meltdown.* Yet that is precisely what happened to the Tennessee Valley Authority's Browns Ferry Plant near Decatur, Alabama.

Mr. Minor (one of the G.E. engineers who resigned) says that his faith in the redundancy of nuclear safety systems evaporated with that fire. Says Mr. Pollard (the NRC project manager who also quit), "In so many near accidents we've had, what caught us up was something no one had thought of."

In effect they are saying that reactor designs have evolved faster than have the abilities of scientists and engineers to understand their frailties.[11]

Dennis Hayes, in a 1976 report for Worldwatch Institute:

Widespread weapons proliferation [spread] is sure to follow on the heels of commercial nuclear power facilities. With each additional finger on the nuclear trigger, the chances of an accidental or intentional nuclear war grows greater.

Harold Sandler, Stanford medical professor:

We are all living at greater cancer risk . . . the cancer death rate is soaring. To move headlong into a technology and economy which will massively produce such biologically harmful substances until more is known seems contrary to every public health principle and medical standard that we know.

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*The grave danger in a nuclear power plant is a "meltdown," that could occur if the water-cooling of the uranium core (and backup systems) malfunction. This would result in an explosion.

Coal

The Utah dispute over the Kaiparowits facility had been particularly bitter because of the location of the proposed plant. It could have supplied energy throughout the Southwest, one of the fastest growing sections of the country. However it was also within 200 miles of 8 national parks and 3 national recreation areas. Kaiparowits would have consumed 1,000 tons of coal per hour and spewed 300 tons of pollutants into the atmosphere every day. The power companies finally gave up their plans for the plant. Here are two reactions to that decision.

Utah State Senator Ernest Dean: "[The action] is a tragedy to all the state. Utah's fossil fuels are plentiful, now they will be locked up instead of creating jobs."

Mrs. Eugene Bliss, member of the League of Women Voters and the Utah Environment Center: "The action shows honest efforts to control the degradation of our environment can be effective."[12]

Many land owners in the West, including a number of American Indian tribes, have refused to let coal companies mine their property. Harold Oberlander, a farmer, was offered $10,000 plus royalties. He refused, saying: "We've got some of the best land in the world. It's a way of life. I want to be able to pass it on to my children. Once they strip the land it will be scarred for centuries to come."[13]

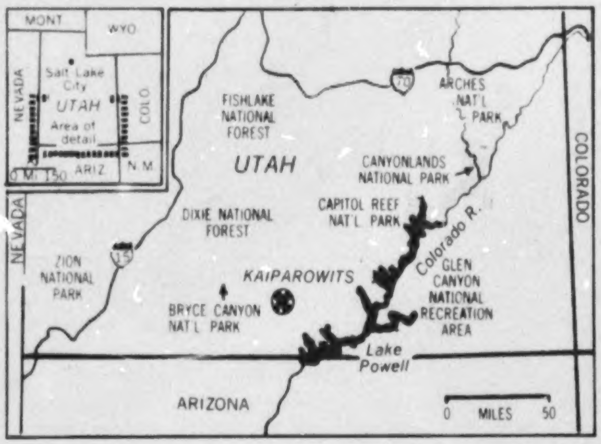
From an ad published by the American Electric Power Co.:

> We're losing sight of the fact that without the application of energy, there can be no production and, without production, the needs of the people cannot be filled. . . .
>
> Increased production is not possible without the increased application of energy. And therein lies the problem. We are becoming more and more dependent for that energy upon precarious foreign sources which can be shut off at any time.
>
> That is why we must turn more and more to coal.
>
> Coal is our only reliable domestic source of abundant raw energy. Locked in it is the extra energy for the needed greater production.

—Find out what sources of energy supply your area. How does this energy production affect the environment? What about state or regional plans for meeting future energy needs?

—You might want to explore other energy alternatives, especially solar and wind energy. Find out what progress is being made, what the potential and the limitations for the future are.

—Find out which levels and departments of government are involved in determining whether we move ahead with nuclear or coal energy. How do they make their decisions?



Conservation: The New Priority in Energy Use

The nuclear vs. coal debate assumes that American's energy needs will continue to spiral upward. Other groups broaden the debate and challenge this basic assumption. How would the situation be altered if we adopted a policy of conservation to restrain consumption and curtail the waste of energy?

The Federal Energy Administration (FEA) has recently made statements that reflect the confusion of the American people over energy issues. First, the FEA has said that the search for new energy resources has "the highest priority." At almost the same time, it was announced that energy conservation will "be given highest priority."

While we continue to wonder just how much energy we can have—and at what cost, in economic and environmental terms—let's consider what conservation could accomplish.

A recent study for the government by a Stanford University research group showed that West Germany uses about ½ the energy per person that Americans use. A similar study of Sweden, by the Lawrence Berkeley Laboratory and the U.S. Energy and Resource Group, produced similar results. Some of the findings of the two reports were:

West Germany

1. Heating homes is about ½ that of the U.S. Reasons: houses are generally smaller; some rooms, like bedrooms are not heated constantly; insulation is better.
2. Electricity: heat is stored in a brick oven at night to take advantage of lower night rates. In the morning, the electricity is turned off and the bricks heat the room.
3. Coils placed above hot water faucets heat the amount of water needed. Hot water heaters are not running constantly at full capacity.
4. There are fewer air conditioners; refrigerators are smaller and used only for essentials.
5. Cars are smaller and more efficient, with greater use of railroads for transporting people and freight.

Sweden

1. A tax on gasoline of 60¢ per gallon discourages automobile use—75 percent of workers use public transportation for commuting.
2. Meat consumption is ½ that of the U.S. Other protein foods require less energy to produce.
3. A higher percentage of Swedes than Americans have vacation cottages. Consequently, they tend to travel less.
4. The government supports railroad and bus systems, making fares lower and encouraging use.
5. Excess heat from power generating plants is used for heating homes and offices.
6. Industry conserves power. The paper industry, for example, uses wastes for fuel, and reduces its power needs per unit to 60 percent of that required by American companies.[14]

—Which of these energy-saving devices would Americans be least *likely* to use? Most likely? For what reasons?

—Do you think Americans could be "educated" to conserve more energy? If so, how?

—How would reducing energy consumption by, say, ⅓ change the strains we place on the natural environment?

EXPLORATIONS

It is easy to waste energy, often because we are not aware of how much energy we are using. Become more aware of your own energy consumption patterns. For example, list all the electrical applicances in your home, such as lights, stoves, hair driers, can openers, etc. (Try to find out which are the biggest users of energy.) Then note the number of services which you use on route to school or work, on the job, in the classroom, etc. Keep a record of the number of minutes or hours that you depend on these energy consumers on a given day. Which are necessities? Which luxuries? How could you cut back on your consumption of energy? What if everyone were to make a conscious effort to cut back on his/her consumption of energy?

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10. From H. A. Bethe, "The Necessity of Fission Power," *Scientific American*, January 1976.

11. From Robert Gillette, "The Age of Nuclear Energy: A Prolonged Adolescence," *New York Times*, February 15, 1976.

12. Both as quoted in the *New York Times*, April 15, 1976.

13. As quoted in *Time*, March 1, 1976.

14. Sources: Richard L. Goen and Ronald K. White, *Energy Use in West Germany* (Stanford, California: Stanford Research Institute, 1976); and Lee Schipper and A. J. Lichtenberg, *Efficient Energy Use and Well-Being: The Swedish Example* (U.S. Energy and Resources Group, 1976).

LESSON 4: THE NEW FRONTIER IN BRAZIL: PEOPLE, PROGRESS AND THE ENVIRONMENT

Breno Augusto dos Santos, a geologist, was making a helicopter survey of a portion of Brazil's vast Amazon region. In the midst of the largely uncharted jungle he spotted two partially bare mountain ranges—even from the air he could see the rust-brown color, which made his heart leap. He landed to take samples, but that was only a formality. He knew he had discovered a huge deposit of iron ore.

Breno's discovery became more important than just iron ore—though it may prove to be the largest single deposit in the world. Eight years of research and testing have led to an estimate of 17 billion tons of ore in the two ranges—enough to fill world iron needs for up to 300 years.

It was the first of many discoveries that are leading to an opening of the great Amazon frontier. Bauxite (aluminum ore), copper, nickel, and dozens of other metals necessary for industry have been found and are being developed. Banks and corporations from all over the world are anxious to take part. Forest products, the potential for oil, and the building of hydroelectric power plants are additional lures.

To get at these treasures will not be easy. New farms, towns, and cities are needed to feed, house, and service all the workers involved in the projects. Roads and railroads must be carved out of one of the most uncooperative environments in the world. Steaming jungles, where rainfall may exceed 100 inches a year, are crisscrossed with treacherous rivers. The great iron ore deposits are in mountain ranges that rise 3000 feet above the jungle floor.

These obstacles, like the tremendous amounts of money, equipment, and labor needed, will be overcome. The stakes are worth every risk. As one American maintenance supervisor said: "We've had geologists and mining engineers here from all over the world. None of them can believe it. It's just too damned fabulous to be true."

The burst of activity in this area ⅔ the size of Canada will have an environmental impact, one the natives of the region have already felt. Unprotected from many diseases previously unknown in the region, thousands have died. The number of Indian tribes had already dropped from 260 in 1900 to 143 in 1973, few with more than 1000 members. A Brazilian National Indian Foundation is making a strong effort to ease the situation, with some tribes being relocated and others maintained in their traditional lifestyles. But the chances are that life for these scattered bands will never again be the same.

No one yet knows what impact economic development will have on the environmental balances within the Amazon region. The Secretary General of the Brazilian Institute of Forest Development has warned that these projects require "large doses of scientific humility, since we must recognize our virtually total ignorance about the Amazonian forest and concentrate efforts to reduce that ignorance through programs and projects of objective research."

Will Brazil avoid the mistakes others have made when opening up wilderness areas? Few observers are optimistic. *New York Times* correspondent H. J. Maidenberg points out that "ecological problems, a key factor in the siting of plants and mines in the industrialized world, have been given a low priority here. In effect, companies have been allowed to export some of their pollution problems" to Brazil.[2]*

[2] Based on H. J. Maidenberg, "Brazil's Underground Riches," *New York Times*, February 29, 1976; "The Mountains of Iron," *Los Angeles Times*, May 12, 1975; and Thomas G. Sanders, "Colonization of the Trans-Amazonian Highway," *Fieldstaff Report*, March 1973.

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*From David C. King and Cathryn J. Long. *Shaping the Environment.* INTERCOM #83. Center for Global Perspectives, September 1976. Reprinted with permission.

DISCUSSION QUESTIONS

1. How has contact with so-called "modern" civilization and technology charged the Indian's way of life?

2. What impact could such a project have on family relationships? On traditional tribal bonds?

3. What are some of the positive aspects of opening up the Amazon region? What are some of the negatives?

4. What criteria would you use to settle the competing claims made by the tribes, and by the mineral developers and the peasants in other parts of Brazil who seek more land? Would you halt development? At what point?

5. What are the values of progress? (i.e., what does progress value?) What does conservation value? Are progress and conservation incompatible?

EXPLORATIONS

A. Read up on the history of the first transcontinental railway in the United States. What changes did the railway bring to the western part of the U.S.? What did it mean for the traditional ways of life of the Indians? Consider also the consequences of improved and increased air transportation in the 20th century.

B. Many other tribal groups around the world are being assimilated by the forces of modernization and urbanization. Use resources such as *National Geographic* magazines, publications of the National Wildlife Federation, and anthropological journals to learn more about the impact of social and technological change on one or more of the following groups: the Eskimos in Northern Canada, the Bushmen of the Kalahari, the Hopi of northeastern Arizona, the aborigines of Australia.

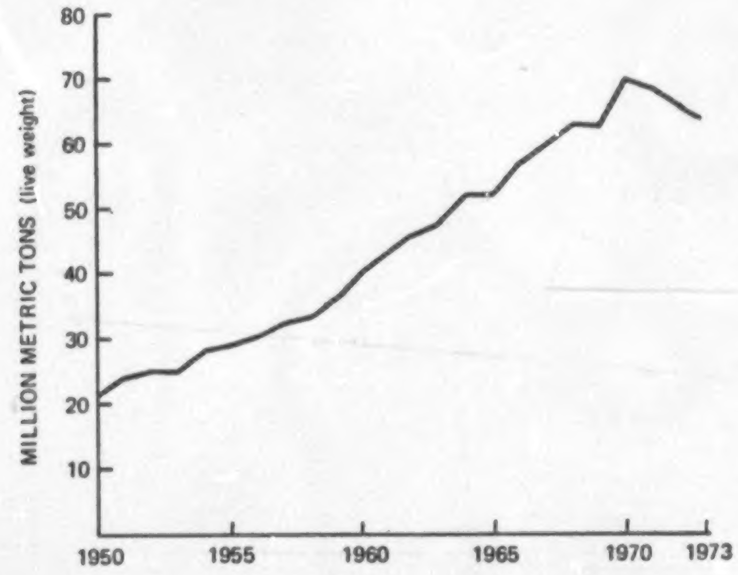
LESSON 5: THE OCEANS

Who owns the oceans and who is responsible for preventing overfishing and pollution? Are the oceans the "common heritage of mankind"? Or, are they the "property" of those countries which have coastlines and the necessary technology to reap the resources? As the extent of and need for what the oceans can yield have become recognized, these and other questions have been debated by politicians, scholars, economists, and others.

As population pressure has pushed land-based food resources to their outer limits, nations have increasingly looked to the seas as a source of food and protein. The annual world fish catch is one of the globe's major sources of high-quality protein (exceeding the world slaughter of beef). It is virtually the only source of high-quality protein for hundreds of millions of the world's poorest people, in parts of China and Southeast Asia and elsewhere in Africa, Asia, and Latin America.

What has been happening to commercial fishing catches over the past fifteen years? Which nations dominate the field? Which consume the most fish? Do you think the situation is fair or should the rules of the game be changed? The graphs and charts below will start you on your way to answering these questions.

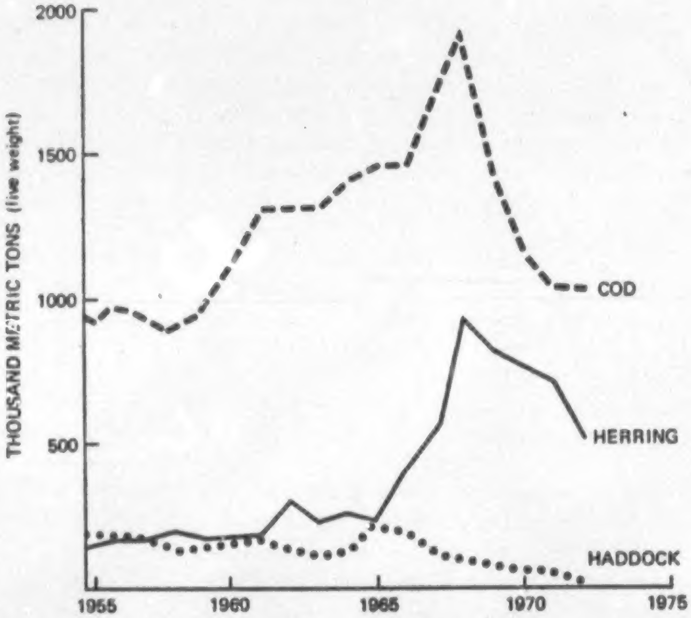
World Fish Catch, 1950-1973



Source: Food and Agriculture Organization.

From Lester R. Brown with Erik P. Eckholm, *By Bread Alone* (New York: Praeger Publishers, 1974), p.151. Reprinted by permission of The Overseas Development Council.

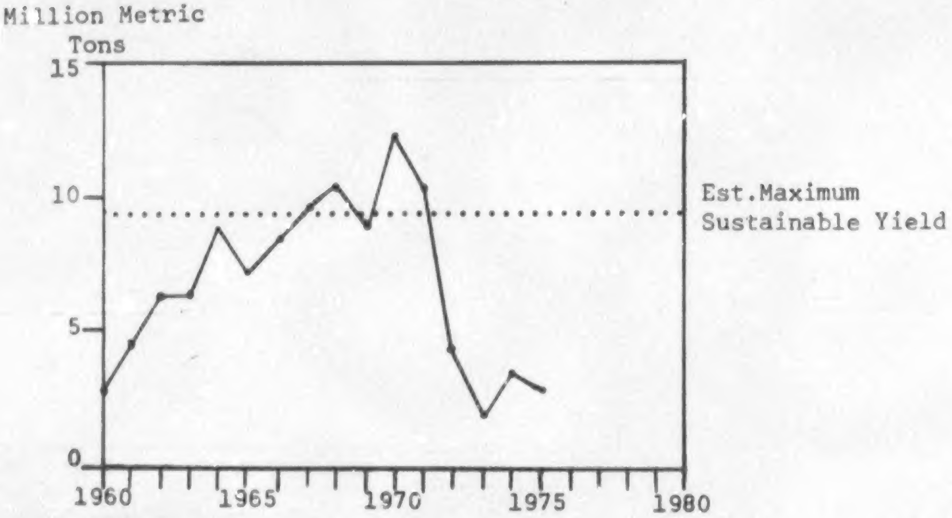
Annual Catch of Selected Species
in the Northwest Atlantic, 1954-72



Source: International Commission for the Northwest Atlantic Fisheries.

From *Ibid.*, p. 154.

Peruvian Anchovy Catch 1960-75



Source: USDA

- The North Atlantic from Rhode Island to the southern coast of Greenland yields approximately 5 percent of the world's catch.
- The fishing off the coast of Peru accounts for about 20 percent.
- Nations fishing in the North Atlantic include those bordering it and Japan, Poland, Rumania, and Russia.

FOR DISCUSSION

1. Look at the three graphs above. What seems to be the trends in worldwide fishing?
2. What do you think is meant by the phrase "maximum sustainable yield"? Does there seem to be some kind of limit to the amount of fish that can be caught year after year? Why is this so?
3. What do you think has caused the drops in catches recently?
4. As demand continues to rise and the supplies dwindle, what will happen to the price? (Confirm your answer by checking with the food purchaser in your family.) How will this affect the eating habits of (a) your family? (b) a Pakistani peasant?

Commercial Catch, Ten Leading Fishing Nations, 1972

	Thousand Metric Tons Live Weight
Japan	10,248
U.S.S.R.	7,757
China	7,574
Peru	4,768
Norway	3,163
United States	2,650
Thailand	1,679
India	1,637
Spain	1,617
Chile	1,487
World Total	65,600

SOURCE: FAO, *Yearbook of Fishery Statistics*, 1972.

Annual Per Capita Direct Consumption of Fish and Shellfish, Fifteen Most Populous Nations

	Pounds, Edible Weight
China	8
India	2
U.S.S.R.	23
United States	13
Indonesia	9
Japan	71
Brazil	6
Pakistan	4
West Germany	9
Nigeria	11
United Kingdom	19
Italy	14
Mexico	4
France	18
Philippines	44

SOURCE: FAO and U.S. Department of Commerce.

5. What characteristic(s) do the ten leading commercial fishing nations have in common?

6. Of the fifteen most populous nations, which country has the highest annual per capita fish consumption? What factors do you think account for this?

7. List the top seven per capita consumers of fish. With the exception of the Philippines, what do these countries have in common?

8. Why do you think the bottom eight on this list consume noticeably less?

THE CONTROL OF THE SEAS

You've got some idea now of the intense competition for fish - and the consequences of overfishing. Should there be controls? In this portion you'll be considering fishing limits - and other issues concerning the use of the oceans. The details and instructions are spelled out on the next pages.

CONTROL OF THE SEAS*

THE OCEAN RESOURCES GAME

> *"The situation right now is like sharks smelling blood in the water; they go crazy, attacking the carcass, tear it to pieces—and kill each other, all at the same time. The states are trying to swallow the carcass of ocean space beyond national jurisdiction and, in the process, are very likely to inflict serious injury on themselves."*
>
> Arvid Pardo, Ambassador to the United Nations from Malta, who, in 1967, first introduced to the UN the question of control of the seas

Nations' preoccupations with food, energy, natural resources, economic growth, environmental pollution, and military security all come together in their concern over the control and use of the world's oceans.

The basic laws of the sea were established in the 17th century and little changed until after World War II. Each nation had control of its coastal waters up to three miles from shore—the distance a cannon ball could be shot. Beyond that the seas were free for all.

New developments have changed this. Improvements in military and commercial technology have reopened the basic question—who owns the seas? Sophisticated fishing enterprises, aided by satellites tracking fish, have raised controversies from Iceland to Peru—and have overfished many regions. Depletion of the land's natural resources and the desire for independence from OPEC-controlled oil (Organization of Petroleum Exporting Countries) have made tapping seabed oil and minerals economically and politically attractive. Pollution of the oceans—from wastes, military use, accidental and intentional oil dumping, and runoffs from land and river pollution—has vastly increased. The control of the seas is now an urgent question for all nations—even those without direct access.

Under the auspices of the United Nations, the process of resolving the complicated questions and writing new laws of the sea has begun. The first substantive sessions, gathering 138 nations, were held in Caracas, Venezuela in 1974. The second Law of the Sea conference was held in Geneva, Switzerland in 1975. These two conferences have been called the most important conferences since 1945. Why do you suppose this is so? Why might the comprehensive treaty, hoped for by the end of 1975, be so vital?

The background data and role-playing activity which follow provide a situation for exploring the potentials for cooperation and conflict that multifaceted global interdependence has created.

We gratefully acknowledge the help of Sidney Holt of the International Ocean Institute, The Royal University of Malta, of Barbara Weaver, a representative of the United Methodist Church to the Geneva Conference, and of the Food and Agriculture Organization, UN, in preparing the *Control of the Seas* section.

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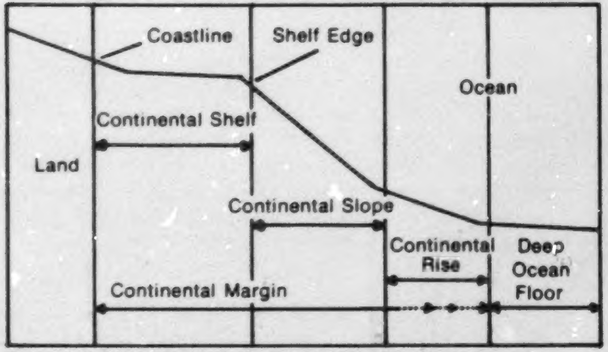
*From William Nesbitt and Andrea Karls, *Teaching Interdependence: Exploring Global Challenges Through Data*. INTERCOM #78. Center for Global Perspectives. June, 1975. Reprinted with permission.

Where Are the Points of Conflict?

Familiarize yourself with the cross section of the ocean floor and the data below. Are all parts of the ocean equally valuable? Locate the areas where the different resources are concentrated. What are some of the potential conflicts?

Diagram of the Seabed and the Ocean Floor



Source: **International Economic Report of the President, 1974.**

- The continental shelf may be as wide as 700 miles, off Siberia, Alaska, and Argentina, and as narrow as a few miles off Peru. The average width is about 40 miles.

- The continental margins may have as much as 40 percent of the world reserves of oil and gas.

- Most fish are taken within 50 miles of shore, and almost all within 200 miles. The ocean supplies 13 percent of the world's animal protein consumption, but fish catches have fallen drastically in recent years. Fishermen have successfully used sophisticated equipment to increase their catches. As a result, though, the remaining fish are insufficient in number to replenish the stock. Overfishing is believed to have contributed to the drop in the haddock catch off Iceland in 1972 to one-seventh of the peak catch of 249,000 tons six years earlier.

- Lying on the sea floor, mostly beyond 200 miles off shore and the continental margins, are great quantities of manganese nodules. These hold a number of metals that are becoming increasingly scarce—primarily nickel (used in making stainless steel), and copper and cobalt. Harvesting nodules eventually may be cheaper than mining them from land.

- At least eight private and governmental groups have already made major investments to prepare to begin ocean mining. Involved are American, Canadian, French, West German, and Japanese concerns.

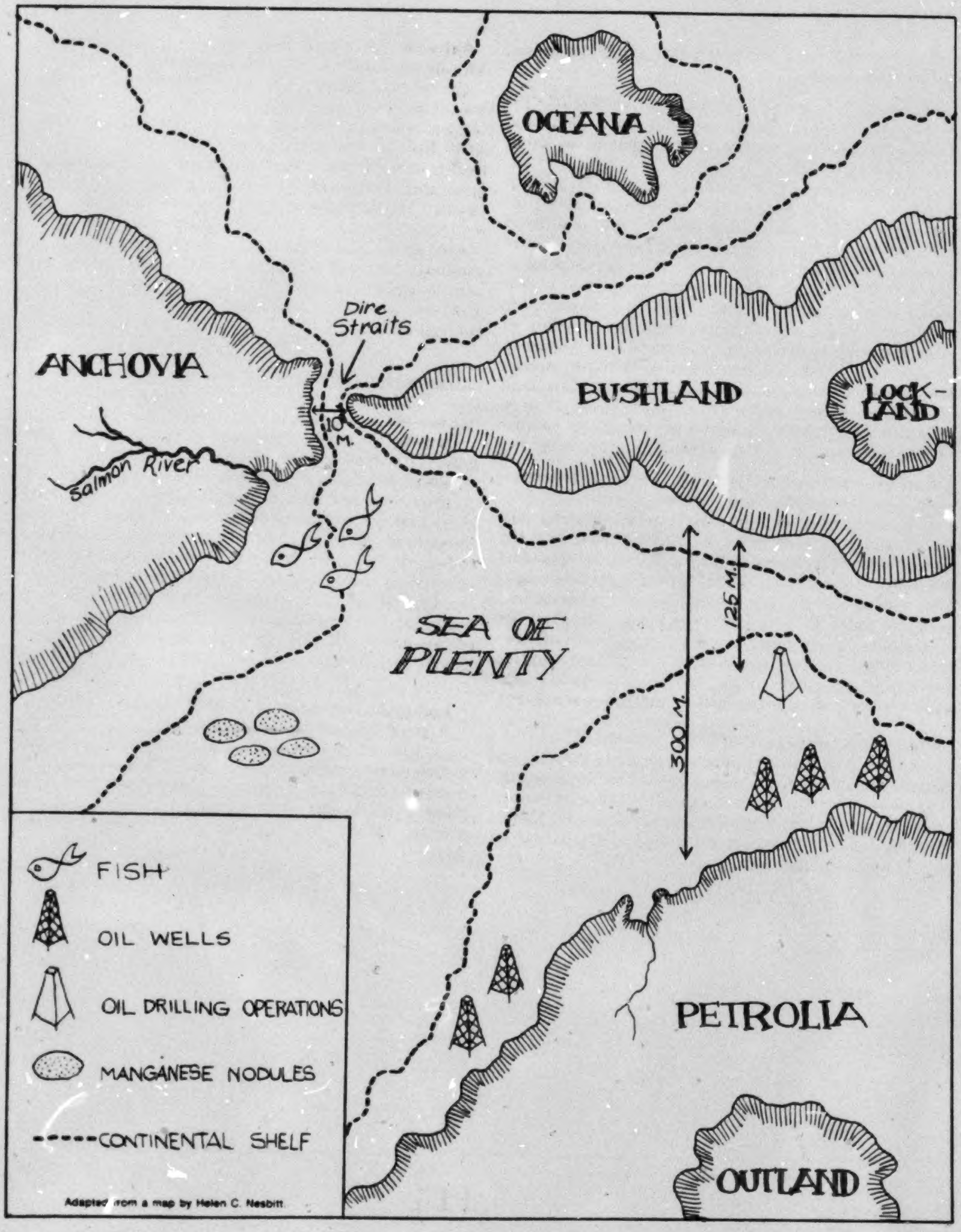
- With increasing shortages of food, oil, and minerals, countries are claiming more rights over the sea off their shores. Now a few nations, including Peru and Ecuador, claim territorial jurisdiction out to 200 miles of coastal seas. But other countries claim only economic control out to 200 miles. (This is an important difference. Economic control gives a nation the right to all the fish and mineral wealth within those limits. Territorial jurisdiction in effect extends the boundaries of a nation's property. All military, navigational *and* economic rights on land would extend to this ocean territorial boundary. Economic rights would not cover military or navigational control.)

- If countries can have territorial jurisdiction beyond three miles, there is a serious problem for the great naval powers, since there would be a threat to free transit through straits. Some coastal nations believe they have the right under the international law of "innocent passage" selectively to control or interfere with shipping in their territorial waters on the basis of the nationality, destination, cargo, or type of ship. Innocent passage also requires submarines to surface and does not consider overflights to be a right. If Spain were to have a 12-mile sea limit, for example, she could theoretically control entrance to the Mediterranean, which, at Gibralter, is less than 10 miles wide. So could Morocco. If Indonesia's and Malaysia's claims to the "archipelago principle" were accepted, Japan's supertankers could be denied passage through the Straits of Malacca and would have to take a costly 6,000 mile voyage around Australia. The great naval powers, such as the United States, are opposed to any extension of jurisdiction which would force their submarines to surface when passing through such straits.

- Some countries, like the Phillipines and Indonesia, claim a 12-mile jurisdiction beyond the outermost islands of their archipelago grouping, thus enabling them to enclose huge areas of ocean within their territorial waters. Take a map of the world—or a portion of the world such as Southeast Asia. Shade in the territorial extensions of each country if it were to claim 200-mile territorial limits. What situations do you see occurring?

- Many of the nations of the world believe the oceans are the common heritage of mankind.

- Most of the poorest countries want an international agency to mine the mineral resources of the seabed and share the profits among nations. Upper Volta, Mali, Botswana, Chad, Afghanistan, and Nepal are among the 13 poorest nations of the world. Look at a map. What do they have in common? How does lack of access impede commerce and economic growth? How does this help explain their position?


OCEANA
Dire Straits
ANCHOVIA
BUSHLAND
LOCK-LAND
10 M.
Salmon River
SEA OF PLENTY
125 M.
300 M.
PETROLIA
OUTLAND
FISH
OIL WELLS
OIL DRILLING OPERATIONS
MANGANESE NODULES
CONTINENTAL SHELF

Adapted from a map by Helen C. Nesbitt

Country Profiles

Students must read the profiles of all the countries, not just their own.

Anchovia: Per capita Gross National Product (GNP) $1,000. Twelve-mile territorial limit. Now claims a 200-mile economic zone; that is, the right to all living and nonliving resources.

Insists on right of innocent passage control with Bushland over the Dire Straits. Concerned about oil spills from drilling around the Sea of Plenty and from the giant tankers from Oceana. The breakup of a smaller tanker caused millions of dollars' damage to beaches and wild life. Fishing, especially of anchovies, is Anchovia's major industry—and the catch is diminishing each year. It is also concerned about the depletion of salmon, which spawn up the Salmon River. Oceana's trawlers take huge catches, often within Anchovia's 200-mile limit, which Oceana insists is legal. Anchovia demands a share of profits from exploitation of deep seabed mineral resources, and it also wants an international agency to license manganese nodule exploitation.

Bushland: Per capita GNP $200. Twelve-mile territorial limit. Two hundred-mile economic zone.

A poor, largely agricultural country. Fishing is a major source of protein for its ill-fed people, and the annual catch is declining, which is blamed on Oceana's mass production fishing with advanced technology. What promise to be rich oil deposits have been discovered 125 miles off Bushland's southern coast. But the deposits are located on Petrolia's continental shelf. Petrolia is also drilling there for oil. Bushland wants a percentage of profits from manganese nodules, with their exploitation controlled by an international agency.

Outland: Per capita GNP $150. Landlocked.

Outland's people once controlled all of Petrolia and deeply resent not having any share in the great wealth coming to Petrolia from oil. Outland insists on a corridor to the sea and that all resources beyond a 12-mile limit belong to all mankind and should be placed under a world-wide organization.

Petrolia: Per capita GNP $4,500. Three-mile limit. Two hundred-mile economic zone.

An oil-rich country and rapidly becoming a major industrial power. Its oil had previously been carried on Oceana's tankers, but now Petrolia is building its own naval fleet. It is insisting upon a three-mile territorial limit to insure free transit or noninterference from Bushland and Anchovia for Petrolian military vessels through the Dire Straits. Petrolia soon will have the technology to take manganese nodules from the deep seabed in the Sea of Plenty. It is therefore opposed to economic zones of 200 miles, which would prevent access to nodules within 200 miles off Anchovia, and it does not want interference from an international-controlling agency.

Oceana: Per capita GNP $5,000. Three-mile territorial limit. Twelve-mile fishing limit. Economic zone on continental shelf to depth of 200 meters.

Oceana is a highly developed industrial and military power. Its ships roam the world and fish with the most advanced technology in the Sea of Plenty, especially off Anchovia's Great Banks and Bushland's shores. Its giant tankers regularly bring vital oil from Petrolia through the Dire Straits to keep Oceana's industries rolling. It maintains a naval fleet, including nuclear submarines, in the Sea of Plenty. Free transit through the Dire Straits is essential for Oceana. It is already beginning to take manganese from the seabed at depths of two miles and more, and opposes any effort to control its activities.

Lockland: Per capita GNP $100. Landlocked.

A poor country desperately attempting to find the capital for economic development, it insists on establishing an international agency that will itself exploit all nonliving resources beyond the 12-mile limit, with profit going to all nations. Such resources are the "common heritage of all mankind," declared Lockland's president.

COUNTERPOINT

ON GROWTH

by René Dubos

Much of contemporary gloom concerning the future originates from the belief that there are "limits to growth" - an expression which has penetrated deeply into the public subconscious from the catchy title of a much-publicized book. One of the themes of this book is that the resources of the earth are limited and that shortages will soon reach critical levels.

Although the phrase "limits to growth" appears self-explanatory, it is in fact deceptive because it hides assumptions and has static connotations that are incompatible with human behavior.

It implies that growth means producing more and more of what industrial societies have been producing at an obscene rate, and that it will therefore require more of the same kind of resources that were used in the past.

History shows, however, that social evolution continuously drives human activities into new channels and that each age creates the resources it needs.

Resources are not as "natural" as usually assumed. They are derived from raw materials that acquire value only after they have been separated from the earth to serve human purposes.

Gold and copper became resources very early because these metals can be extracted and manipulated by simple techniques. Iron did not become a resource until much later because it requires more complex technologies. Aluminum became a resource only after sophisticated methods had been developed to derive it from bauxite at the turn of the century. And so it goes for other metals.

Agricultural lands, also, had to be created out of the wilderness by human ingenuity and labor. In North America this involved clearing the forests that used to cover a large part of the continent, using the plow "that broke the plains," draining marshes and irrigating semidesert areas. Much of what is called nature was for ages some aspect of wilderness that has been transformed by human efforts.

One kind of growth is simply the exploitation of the materials stored in the earth; another more interesting kind results from the transformation of raw materials into resources through a continuous evolutionary process.

To a large extent, in other words, growth means the evolution of the man-made. The creativeness of social evolution is strikingly evident in the change of attitudes regarding sources of energy.

For millennia, all work was done by human and animal muscles. During the Middle Ages, mechanization began with the use of water mills and windmills. The Industrial Revolution operated its machines first with wood, then with fossil fuels such as coal, petroleum products, and recently uranium.

At present, studies are going on all over the world to determine what sources of energy are best suited for each individual purpose and what are the safe limits in the production and use of energy.

The awareness that the supplies of fossil fuels are limited is now directing thought to renewable sources - for example, nuclear fission and the sun - and to the vital contribution made by the wilderness to the energy balance of the earth.

In any given year, the total amount of energy derived from the sun by the photosynthetic activities of wild vegetation greatly exceeds the total amount used to support human life and to drive technologies. The problem of energy supplies thus leads back to concern about the preservation of nature.

The meaning of the word "growth" has evolved also with regard to human existence. Quantitative growth, for its own sake, is no longer socially acceptable because it threatens the quality of life and of the environment.

In the countries of Western civilization, many members of the upper and middle classes are beginning to recognize the merits of a less-consuming society. Just as this bellwether group led the movement toward smaller families, so it may eventually transmit new social values to the rest of the population.

In matters of growth, the new mentality is more important than advances in science and in technology. The fact that a good environment is now considered one of the "inalienable rights" will probably influence the design of future technologies as much as scientific discoveries have in the past.

Even though the phrase "quality of life" does not define a social philosophy, it symbolizes an attitude that can be contrasted with the following statement from the guidebook prepared for the 1933 Chicago World's Fair: "Science finds, industry applies, man *conforms.*"

Today, 40 years after the 1933 World's Fair, no one would dare state that humankind must conform to technological imperatives. The goal is rather to make technology conform to human needs and aspirations.

This involves a kind of qualitative growth for which there are no discernible limits, because social evolution is more inventive than biological evolution and more creative of resources really valuable for human existence.*

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* *New York Times,* November 11, 1975. © 1975 by The New York Times Company. Reprinted by permission.

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